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SOILS OF THE MANAWATU DISTRICT.

PART II. THE HUMUS SOILS.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

ORIGIN.

IN considering the humus or peaty soils of this district some space may be devoted to an attempt to understand how they have been formed. It would seem that the advance inland from the sea-coast of the wind-borne sand has resulted in the damming-back of the drainage waters from the higher levels, and the blocking-up of the creeks and watercourses at or near their mouths. This has resulted in the formation of shallow lakes, raupo swamps, sphagnum bogs, and waste areas of rush, reed, and flax. The final development into swampy forest, with the white-pine and the pukatea as the dominant forest-trees, may be assumed to be the final stage of the development as a swamp, and one which would persist for a long period. An excellent example of a swampy forest is the Round Bush at Foxton, where, surrounded by high sandhills, on an area on the sand, tall white-pine forest has developed, although the floor is completely covered with stagnant water. One can walk through the forest dryshod only by treading on the gigantic tree-roots which have raised themselves above

the soil and water—an adaptation which the many forest-trees of swamps have evolved in order that oxygen may be obtained for the roots.

Starting, therefore, with a shallow pond formed on sand, the growth and decay of aquatic plant-life soon forms a covering on the bottom. Various water-plants flourish and die, and the remains, protected from complete oxidation, accumulate. Raupo or bulrush (*Typha*), being specially adapted for growth in a submerged area, invades the water, and adds by the growth and much annual shedding of bulky dead vegetable tissue to the accumulation of organic matter. The raupo spreads throughout the ponds, its long flexible and cylindrical stem being extraordinarily well fitted to resist the pressure from wind or water currents. Gradually the pond fills up sufficiently to permit the growth of sphagnum moss, a wonderful and most useful plant, and one which deserves wider recognition and utilization in this country.* Sphagnum, owing to its spongy nature, is able to absorb large quantities of water; each plant is able to continue growing upwards while the lower portions are decaying and forming peat. It can thus enjoy a perpetual existence and flourish on the stratum which it is continuously building from the products of its decay. The sphagnum bog is now invaded by all kinds of plants capable of living in a medium fully saturated with water. Rushes, sedges, reeds, the liliaceous flax (*Phormium*), and cabbage-tree (*Cordyline australis*), manuka, heaths, and coprosma bushes — the last three being woody plants—are among those which may be found in sphagnum bogs. From a shrubbery to a forest is the last stage.

In the flax-milling industry of the Manawatu it has been found possible to hasten in large areas the natural succession of swamp into pure flax swamp, when the former has reached the stage of supporting stunted flax-plants at fairly wide distances apart. Artificial drainage results in the establishment of the optimum conditions for the growth of flax, the few stunted plants seed the area, and the whole becomes tenanted with what is practically a pure association of flax, forming at its best a dense jungle through which one can only force oneself with difficulty.

COMPOSITION.

In the organic soils now growing herbaceous plants, such as phormium, the outstanding feature in which the soil differs from others of the vicinity is the large amount of organic matter (consisting of the more or less decayed vegetable-remains) present compared with the inorganic or mineral matter (sandy or silty particles). In these flat areas liable to be flooded by the contiguous rivers the amount of

* Dried sphagnum moss was extensively used during the late war as a most efficient antiseptic and absorbent dressing for wounds. Gardeners and nurserymen use it for packing round the roots of garden-plants and young trees: the well-known property that sphagnum possesses of keeping moist to any extent desired without putrefying or becoming mouldy constitutes it an ideal material for the purpose. In the human nursery it is now becoming a fashionable packing for young babies. The Maoris may often be seen drying it in the sun for stuffing into bedding in the same way as kapok and feathers are used. Its absorbent, antiseptic, and resilient properties make it an admirable substitute for other bedding-material. Its name, or a derivative, has been used to designate various proprietary pharmaceutical articles at present imported into New Zealand and presumably made from it or its products.

mineral matter, as one might expect, varies greatly. Certain swamps or portions of them which are never flooded by river-water show remarkably high percentages of organic matter—as, for instance, those of Waikanae and Otaki. In these there is only from 15 to 30 per cent. of mineral matter. In stations where such a river as the Manawatu is able to flood and deposit large quantities of silt and fine sand on the swamps from time to time, it will be found that mineral matter may be present in the soil in amounts exceeding 80 per cent.

The nitrogen of these humus soils varies considerably; in one of the Waikanae soils the amount present was 2·85 per cent. When one considers that the quantity of nitrogen in steamed bonedust is about 3·3 per cent., it will be seen that there is a large amount of

SWAMPY FOREST ON SAND, WAIKANAE

Showing reed (*Gahnia*) and cabbage-tree (*Cordyline*) round margins.

[*Photo, B. C. Aston.*

fixed nitrogen in these organic soils, but, unlike that of bonedust, it is only slowly available for use as plant-food. The accumulation of these deep deposits of organic matter is due to excessive moisture, absence of oxygen, and low temperature, and it is only when the land is drained and aerated that the nitrogen becomes available for pasture and ordinary crops.

As these swampy areas are often adjacent to huge sand deposits it may perhaps be possible at some future date to open up channels through the sand, enabling the wind to blow sand on to the swamp, thus cheaply transporting quantities of that very mineral matter, in a fine state of subdivision, which is required to convert the organic matter into a fertile soil. As bearing on this subject may be mentioned the translation of a French work on sand-reclamation in France ("The Fixation of the Dunes of Gascony," by E. Harlé. N.Z. Forestry Department, Wellington, 1920), in which it is shown how by human

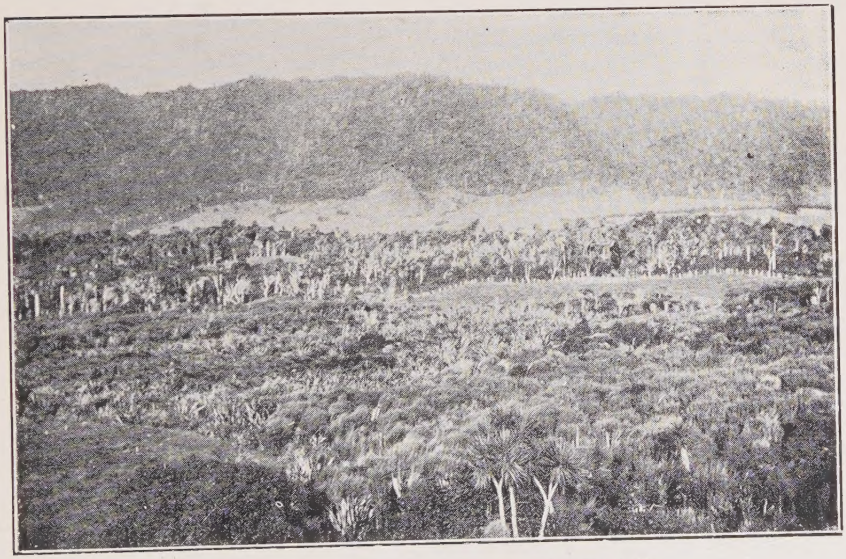
ingenuity the forces of nature have been directed at a comparatively low cost so as to transform large areas of dangerously drifting dunes into forest or other stabilized surface. For details the work referred to should be consulted, but it may be briefly explained that by a series of palisades the sand may be directed by the force of the wind to the position in which it is required. Of course, in filling in a swamp much levelling by means of horse-power may be required, but the idea is that the wind should do a large share of the work. The addition of organic matter to sandy country has always been considered a better way of ameliorating it than by applying lime, and the application of peaty soil to sandy soil, or *vice versa*, is highly commendable when practicable.

The citric-acid and hydrochloric-acid extraction of these swampy soils yield figures for the chief mineral plant-foods, which are extremely variable, a result which is probably due to the varied history of the different areas sampled. The coastal lands have in the past doubtless undergone great changes affecting comparatively small areas at a time. Local sand-drifts may have profoundly affected some areas, either by blocking the drainage and thereby inducing swampy conditions, or by filling up swamps and making good dry land. Rivers in flood may have carried large quantities of sand, silt, and clay over peaty soils, thus ameliorating them by the admixture of mineral matter; the receding of the sea may have left salt areas or deposits of shells which have induced a different type of vegetation; and the smaller rivers have no doubt changed their courses, as has been the case with the Waikanae River, the old course of which may be plainly seen to this day. All of these courses have no doubt contributed to the variability in composition which at present exists in the soils and subsoils of the district, the lower-lying or swampy ones being especially liable to alteration. Elevation or depression of the coast area no doubt also played a part in effecting changes accentuating local differences of composition.

Generally speaking, these organic soils are rich in available and total potash when compared with others of the same class. This fertilizer ingredient one would expect to be the dominant one required by phormium as a fibre or cellulose-producing plant. Sir A. Church, from analyses of English-grown fresh leaves of flax made in 1876, estimated that 100 lb. of green flax-leaves (butts) would yield $\frac{1}{3}$ lb. of potassium carbonate. He also found that the dried leaves contain 19·2 per cent. of sugar (or 4 to 5 per cent. on the fresh leaves). Thirty tons of flax per acre every four years is considered a good average yield, although this quantity is sometimes doubled, and it takes about 8 tons of green leaves to produce one ton of fibre. All plants which elaborate in their tissues large quantities of starches, sugars, fats, or cellulose require a soil which will yield large quantities of available potash. This would be especially true of plants with a limited root-system. Phormium has a comparatively poor root-system, and if only the rooting-system could be stimulated to search for it there need be no fear of a deficiency of potash.

Phosphoric acid, the other important fertilizer constituent, is not so conspicuously plentiful, and hence one would predict that application of phosphates to these soils when properly drained would result in

TAWA AND KOHEKOHE GROWING ON ANCIENT DUNE, WAIKANAE.



LOOKING INTO HOLLOW ON SAND, WAIKANAE.

Flax and reed swamp developing into manuka scrub, and finally into forest.

[*Photos, B. C. Aston.*

much greater yields of crops. Stimulating the root-action by means of a solution of superphosphate, or by applying finely ground phosphate rock, might be tried as a means of combating trouble in the flax crop.

Lime is usually present in plentiful amounts, but is sometimes overbalanced by magnesia, as in the Rangitane Swamp, which suggests that the past influence of sea-water on the areas in which this excess occurs may be looked for. This excess of magnesia over the lime in the soil and subsoil of some of the worst yellow-leaf disease areas is interesting. The incidence of unbalanced lime-magnesia ratio has been noticed before in soils on which deficiency diseases develop in animals (see Annual Report of this Department for 1918–19), but not previously in diseases of plants.

In spite of there being plenty of lime present the avidity for lime shown by these humus soils, or "muck" soils, as they are called in America, is still very great, and they are able to absorb up to 1·5 per cent. of their weight of lime from a solution of bicarbonate of lime. One does not recommend, of course, the application of such huge amounts as this would involve, although a moderate liming with carbonate would do much to establish a healthy growth of grass on the well-drained soil. As an ameliorating agent for sand it cannot be too strongly urged that humus or organic matter is the very best application to make, just as for organic or peaty soils after drainage the very best treatment would be the admixture of sand containing insoluble plant-food, but which the soil water of peaty lands will speedily make soluble and available for plant-food. Another cheap method of ameliorating deep peaty soils is by controlled burning to a certain depth, as advocated in the *Journal* for July, 1917. On page 28 of the same issue Mr. A. Seifert is quoted as stating that burned areas are considered the best flax land.

NOTES ON THE SOILS ANALYSED (SEE TABLES).

H 376.—Collected (12/11/16) to depth of 15 in. in a small drained swamp behind Ngarara homestead. Swamp surrounded by sandhills. Now used as a vegetable garden. Last native vegetation manuka, flax, and raupo.

H 384.—Collected (13/11/16) in swampy forest on Waikanae sandhills. Pukatea-white-pine forest of pukatea (*Laurelia*), white-pine, tawa, kohekohe (*Dysoxylum*), swamp-maire. Underscrub of mahoe, ngaio, tutu, whauwhau (*Panax arboreum*), *Myrsine Urvillei*, lancewood, manuka (*Leptospermum scoparium*), *Pittosporum tenuifolium*, *Muehlenbeckia australis*, *Phormium tenax*, *Coprosma tenuicaulis*, *C. robusta*, *C. grandifolia*, hangehange (*Geniostoma*), *Carpodetus*, *Hedycarya*, *Olearia Cunninghamii*, *Weinmannia*, fuchsia. Lianes and Epiphytes: Kiekie (*Freycinetia*), *Rubus schmidelioides*, climbing ratas (*Metrosideros scandens*, *M. florida*), *Parsonsia*, and tree-ferns.

H 623.—Collected (3/3/17) in white-pine forest, about three miles from sea on the Levin Beach Road.

J 118.—Collected (28/4/17) from Rangitane flax swamp (Louis Seifert's), top 300 acres, which was at that time comparatively free from yellow-leaf disease. Taken to a depth of 9 in.

J 121.—Collected (28/4/17) from Rangitane flax swamp (L. Seifert's), bottom 300 acres, on which yellow-leaf had developed considerably, the roots having died out and the yield of flax greatly diminished. Taken to a depth of 9 in.

J 166.—Collected (12/5/17) in Brown's flax swamp, near Waikanae. No yellow-leaf developed in this portion of the swamp.

J 393.—Collected (29/9/17) in white-pine forest, Round Bush, Foxton. Forest of white-pine, pukatea, pokako (*Eleocarpus Hookerianus*), swamp-maire (*Eugenia*), rewarewa (*Knightia*). Underscrub of titoki, hangehange, myrtle (*Myrtus bullata* and *M. obcordata*), *Carpodetus*, *Hedycarya*, kiekie, *Myrsine Urvillei*, kawakawa (*Piper excelsum*), with many perching ferns and epiphytes on the exposed roots of the swamp trees and branches.

K 246.—Collected (18/8/18) in small flax swamp, about 15 acres, in Ngarara West A Block, Section 45, near Waikanae; drained, and now growing *Phormium tenax*, *Mariscus*, *Carex secta* (niggerhead), and English pasture in interspaces.

K 363.—Collected (2/9/18) in drained niggerhead swamp. Sampled to depth of 9 in. Black soil. Situated two miles north of Paekakariki Railway-station, on main road. Native covering—niggerhead, *Mariscus*, and rush (*Juncus* sp.)—being converted into English pasture grasses. As there are many buried stumps the original vegetation was probably pukatea swampy forest.

K 377.—Collected (21/9/18) in Jensen's improved swamp land, Block VIII, Waitohu Survey District, Section 6, Ngakaroro. This was originally a swamp, but has now been drained, and is carrying a good rye-grass and clover pasture, with some tall fescue at edges. Black soil taken from a flat area about 30 ft. below the Otaki sandstone scarp.

K 381.—Collected (21/9/18) in white-pine association in recent sand hollow on west side of road one mile south of Te Horo. Forest consists of white-pine, tawa, with a little red-pine (rimu). Underscrub of mahoe, supplejack, kohekohe, rangiora, hangehange, lancewood, *Coprosma grandifolia*, *Myrsine Urvillei*, *Knightia*, *Hedycarya*, lawyer (*Rubus australis*), &c.

K 385.—Collected (12/9/18) from a well-known paddock adjacent to the Manawatu River at the Foxton Bridge, which consists of partially submerged flats growing a pure association of *Glyceria fluitans* (floating manna-grass). This water-grass contains a comparatively large amount of sugar, and is hence eagerly devoured by cattle. The area is used as a fattening-paddock for stock as soon as the flood-waters subside low enough. Sample taken to 9 in. depth.

K 391.—Collected (23/9/18) in forest opposite Ravensworth Dairy Factory. Originally white-pine forest, judging from the numerous stumps and saplings, but now growing forest of tawa, *Knightia*, mahoe, titoki, hinau, matai, with underscrubs of *Melicope simplex*, ribbon-wood (*Hoheria lanceolata*), supplejacks, *Muehlenbeckia australis*, milk-tree (*Paratrophis heterophylla*), *Coprosma areolata*, tree-ferns, *Myrtus bullata*, *Pseudopanax*, *Myrsine Urvillei*, *Parsonsia*, *Passiflora*, ngaio, poroporo, maire, *Carpodetus*, clematis, *Gahnia xanthocarpa*, and ferns.

MANAWATU DISTRICT HUMUS SOILS.—CHEMICAL ANALYSES.

Results except * are percentages on soil dried at 100° C.

Laboratory No.	Locality.	Volatile Matter.			Total Nitrogen.	1-per-Cent. Citric-acid Extract, Dyer's Method; Hall's Modification ("Available" Plant-food).				Hydrochloric-acid Extract ("Total" Plant-food).				Lime-requirement (Percentage $CaCO_3$).	
		*On Air-drying.	*At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	On Air-dried Soil.	On Soil dried at 100° C.
	Flax, Raupo, and Herbaceous Swamps.														
H 376	Waikanae	61·0	2·49	18·01	0·420	..	..	0·019	0·014	0·97	0·54	0·17	0·08	..	..
K 377	Otaki: Jensen's swamp	67·3	31·26	85·27	2·378	0·869	0·239	0·025	0·069	1·60	0·09	0·21	0·37	0·53	0·77
K 385	Foxton Bridge: Humus silt	58·1	7·40	28·21	1·077	0·175	0·048	0·018	0·007	1·16	0·81	0·71	0·26	0·50	0·54
K 397	Tokomaru: Flax swamp	61·8	21·02	43·35	1·368	0·259	0·073	0·030	0·017	0·75	0·49	0·40	0·23	0·81	1·00
K 246	Ngarara West: Flax swamp	78·5	37·94	63·26	2·488	0·857	0·320	0·078	0·037	2·58	0·63	0·24	0·29	..	..
K 517	Timukanui Ltd. swamp	..	8·66	29·40	0·975	0·376	0·114	0·051	0·011	0·97	0·79	0·88	0·07	..	..
K 519	Tane: Flax swamp	45·6	5·38	15·78	0·482	0·331	0·084	0·038	0·016	1·10	1·35	0·50	0·12	0·26	0·27
K 521	Mirinui: Flax swamp	70·3	9·58	51·41	1·567	0·391	0·134	0·049	0·016	1·00	0·38	0·28	0·20	0·73	0·81
K 523	Mirinui: Flax swamp	67·9	13·64	47·00	1·530	0·410	0·147	0·057	0·015	0·90	0·65	0·67	0·21	0·66	0·76
L 433	Paraparaumu: Flax swamp	51·2	8·16	35·01	1·022	0·213	0·094	0·039	0·022	0·48	0·49	0·40	0·17	0·90	0·98
L 439	Waikanae: Price's and Hadfield's swamps	50·0	25·14	79·64	2·849	0·746	0·219	0·040	0·026	0·43	0·74	0·20	0·32	0·93	1·24
L 141	Te Horo: Singer's Swamp	58·4	28·84	61·75	2·385	0·344	0·168	0·054	0·006	0·93	0·31	0·33	0·16	1·42	2·00
J 166	Waikanae: Brown's swamp	63·7	21·07	70·00	0·581	..	..	0·041	0·015	2·32	0·60	0·24	0·25	..	..
J 118	Rangitane: Flax-mills (Seifert's), top	43·1	6·24	11·42	0·274	..	..	0·071	0·020	1·14	1·15	0·33	0·10	..	..
J 121	Rangitane: Flax-mills (Seifert's), bottom	47·6	8·70	11·47	0·274	..	..	0·018	0·019	1·26	1·32	0·35	0·12	..	..
	Subsoils of Flax, Raupo, and Herbaceous Swamps.														
K 378	Subsoil of K 377	41·4	67·12	90·80	1·867	0·369	0·167	0·031	0·005	2·45	0·72	0·15	0·08	0·67	2·30
K 386	Subsoil of K 385	64·4	8·96	34·77	1·151	0·452	0·123	0·050	0·021	1·27	0·67	0·28	0·21	0·51	0·56
K 398	Subsoil of K 397	78·6	10·82	49·56	1·320	0·301	0·106	0·031	0·011	0·86	0·57	0·39	0·20	0·86	0·96
K 247	Subsoil of K 246	85·7	14·58	78·18	2·315	0·779	0·334	0·133	0·023	2·17	0·63	0·35	0·14	0·67	0·78
K 518	Subsoil of K 157	..	11·80	46·50	1·266	0·383	0·142	0·054	0·010	1·04	0·82	0·75	0·16	..	..
K 520	Subsoil of K 519	60·0	7·58	21·10	0·555	0·294	0·065	0·036	0·013	1·02	1·02	0·53	0·12	0·38	0·41
K 522	Subsoil of K 521	68·8	12·26	49·88	1·385	0·521	0·167	0·064	0·019	1·29	0·68	0·38	0·21	0·70	0·80
K 524	Subsoil of K 523	80·0	12·44	59·81	1·425	..	..	..	..	..	..	..	..	0·92	1·10
L 434	Subsoil of L 433	38·6	5·06	16·01	0·348	0·127	0·040	0·033	0·029	0·35	0·44	0·32	0·14	0·40	0·42
L 440	Subsoil of L 439	..	14·74	81·49	..	0·538	0·064	0·057	0·007	2·21	0·40	0·27	0·19	1·06	1·24
L 142	Subsoil of L 141	..	20·44	73·95	..	..	..	..	..	..	..	..	..	1·30	1·63
J 167	Subsoil of J 166	70·4	30·29	77·16	2·088	..	..	0·081	0·012	1·03	0·39	0·09	0·20	..	..
J 119	Subsoil of J 118	52·6	11·66	18·78	0·383	..	..	0·012	0·013	1·19	0·98	0·27	0·10	..	..
J 122	Subsoil of J 121	54·0	8·24	14·64	0·444	..	..	0·014	0·013	1·03	0·93	0·32	0·09	..	..
	Swampy Forests on Silt.														
L 417	Paekakariki: White-pine forest (opposite Lynch's)	58·3	12·74	46·98	1·450	0·524	0·153	0·045	0·024	1·27	0·56	0·48	0·24	0·48	0·55
L 441	Waikanae: White-pine forest (opposite Tatton Fraser's)	31·2	5·72	13·78	0·484	0·169	0·050	0·038	0·029	0·57	0·19	0·71	0·16	0·46	0·49
K 363	Paekakariki: Niggerhead swamp with raupo	70·2	13·42	54·71	1·432	0·463	0·113	0·060	0·028	1·54	0·34	0·32	0·24	0·94	1·17
K 391	White-pine swamp	27·8	3·54	9·12	0·300	0·096	0·039	0·034	0·009	0·58	0·28	0·22	0·05	0·22	0·23

	Subsoils of Swampy Forests on Silt.														
L 418	Subsoil of L 417	29·4	11·88	52·00	1·456	0·386	0·137	0·040	0·011	1·04	0·52	0·52	0·19	0·72	0·82
L 442	Subsoil of L 441	31·1	7·20	12·54	0·389	0·126	0·038	0·029	0·015	0·93	1·02	0·73	0·09	0·33	0·36
K 364	Subsoil of K 363	80·5	12·84	70·60	..	0·384	0·109	0·040	0·010	..	..	..	..	1·23	1·41
K 392	Subsoil of K 391	31·3	4·30	5·28	0·158	0·042	0·041	0·020	0·002	0·54	0·40	0·30	0·04	0·21	0·22
	Swampy Forest on Sand.														
K 381	Te Horo: White-pine on sand	27·8	13·84	12·37	0·221	0·214	0·074	0·038	0·009	1·01	0·42	0·31	0·03	0·13	0·15
H 384	Waikanae: Swampy forest on sand.. ..	35·0	16·98	10·86	0·186	..	..	0·037	0·010	0·99	0·35	0·19	0·69	..	..
H 623	Levin: Whi'e-pine on sand	30·3	13·23	19·03	0·478	..	..	0·015	0·013	0·77	0·56	0·08	0·11	..	..
J 393	Foxton: Swampy forest on sand	48·7	24·21	16·95	0·567	..	..	0·036	0·023	1·57	0·26	0·42	0·11	..	..
L 136	Te Horo: Swampy forest, drained	..	17·08	47·80	1·926	0·363	0·154	0·044	0·010	..	..	..	..	1·48	1·78
L 435	Waikanae: Manuka bog	..	15·26	78·78	1·646	0·180	0·204	0·057	0·020	0·20	0·26	0·20	0·20	1·53	1·81
	Subsoils of Swampy Forest on Sand.														
K 382	Subsoil of K 381	32·3	3·46	8·88	0·284	0·157	0·059	0·027	0·005	0·65	0·41	0·14	0·05	0·12	0·12
H 385	Subsoil of H 384	23·0	7·52	4·53	0·059	..	..	0·014	0·008	0·88	0·48	0·19	0·06	..	..
H 624	Subsoil of H 623	27·4	11·08	10·61	0·214	..	..	0·009	0·008	0·74	0·70	0·13	0·08	..	..
L 137	Subsoil of L 136	..	21·30	65·21	2·554	0·390	0·146	0·061	0·005	1·44	0·53	0·32	0·11	1·15	1·46

MANAWATU DISTRICT HUMUS SOILS.—MECHANICAL ANALYSES.

Results are percentages on air-dried soil.

Lab. No.	Description of Soil. (Classification of U.S. Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.						Stones and Gravel.
		Fine Gravel.	Coarse and Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture and Loss on Ignition.	
H 376	Sandy soil	Nil	66·0	7·0	0·6	1·7	25·3	..
K 385	Silt loam	,,	14·7	13·4	18·9	21·4	33·5	..
J 118	Silt loam	,,	16·9	35·8	25·2	3·2	19·2	..
J 121	Sandy silt	16·2	28·4	19·0	11·6	1·8	21·6	..
J 119	,, ...	10·1	22·0	18·9	13·8	3·0	30·9	..
J 122	Silt loam	Nil	18·9	29·6	23·6	2·1	23·8	..
L 441	Sandy loam	,,	33·3	24·6	12·4	11·8	18·7	..
K 391	,, ...	,,	26·1	37·7	14·7	10·3	12·3	..
K 392	,, ...	,,	26·7	33·7	12·3	15·9	9·4	..
K 381	,, ...	,,	50·4	12·2	7·3	5·5	24·5	..
H 384	Sandy soil	,,	60·5	8·2	1·1	Ni	30·2	..
H 623	,, ...	,,	60·2	2·2	0·1	,,	35·3	..
K 382	,, ...	,,	68·0	11·8	7·2	3·7	10·1	..
H 385	,, ...	,,	72·4	9·0	3·2	Nil	13·8	..
H 624	,, ...	,,	69·9	2·2	0·1	,,	24·5	..

K 397.—Collected (23/9/18) in Makerua flax swamp, near Tokomaru Railway-station, in black soil growing a pure dense association of phormium.

K 517.—Collected (22/12/18) from the swamp of Timukanui Limited, from a flax area affected with yellow-leaf.

K 519.—Collected (22/12/18) in Tane flax swamp (Seifert's), Block 2G, near bridge, in an area very badly affected with yellow-leaf. Area much infested with tall fescue.

K 521.—Collected (3/1/19) in Mirinui flax swamp (Seifert's), near Shannon, beyond drain and near Sweater's corner.

K 523.—Collected (3/1/19) in Mirinui flax swamp, second turn past Shannon drain.

L 136.—Collected (15/6/19) in drained swamp, Te Horo (Singer's). Sampled 1 ft. deep. Land in hummocks, stumps, and grass.

L 141.—Collected (15/6/19) at Te Horo, in Singer's drained swamp, containing large number of tree-stumps (matai, totara, rata, pukatea). Now coming into grass. Native Block 2F 3A.

L 417.—Collected (19/9/19) in swampy forest growing white-pine, pukatea, swamp-maire, kiekie, *Muehlenbeckia australis*, ngaio, *Coprosma*, wineberry, *Schefflera*, tutu, *Clematis indivisa*, *Geniostoma*, mahoe, supplejack, *Pittosporum*, with raupo swamp round the edge of the forest. Lynch's Bush, Paekakariki, on west side of railway-line, opposite Lynch's homestead. Black soil.

L 433.—Collected (20/9/19) in Mrs. Hadfield's flax swamp, Para-paraumu, below forest. Almost a pure association of dense phormium with occasional niggerhead and trace of *Mariscus*.

L 435.—Collected (20/9/19) in manuka bog near Waikanae. Vegetation consists of stunted manuka, bracken, sphagnum moss, rushes, and *Lomaria capense* (bog variety). Water-level very near surface.

L 439.—Collected (21/9/19) in F. Price's swamp land, Waikanae (next to Brown's flax swamp), part of Hadfield's estate. Partly grassed flax land, previous to that was a niggerhead swamp with much buried timber.

L 441.—Collected (21/9/19) in swampy forest similar to No. 417. Tatton Fraser's, west side of railway-line, opposite Tatton Fraser's homestead, Waikanae. Pukatea, tawa, and *Muehlenbeckia australis*, abundant; also wineberry, mahoe, *Coprosma grandifolia*, *Cyathea medullaris*, kiekie, nikau, poroporo, with occasional trees of white-pine. Forest much invaded by elder. Taken to a depth of 9 in.

(To be continued.)

Rabbit-poisoning. — Mr. McGregor, of Mount Linton, supplements his remarks on rabbit-poisoning at the head of page 8 in last month's *Journal* by a note to the effect that, where possible, the phosphorized pollard should be laid in a very light plough-furrow, or even on a sod turned over with a spade or mattock. This often gives a most satisfactory result, and stock are less liable to pick up the baits.

PLANT INDICATORS.

A NEW LINK BETWEEN SCIENCE AND PRACTICE IN AGRICULTURE AND FORESTRY.

DR. L. COCKAYNE, F.R.S., F.N.Z.Inst., Wellington.

AT the present time, as an outcome of the war, the national importance of scientific research is in the public mind as never before. But when this appreciation of science is analysed it stands out clearly that only the application of the various sciences is usually meant—the research to be entirely of an economic character. Indeed, the non-scientific belief is that "pure science," as it is styled, is of comparatively little moment. It should be needless to point out how fallacious is this standpoint, for a moment's thought shows that there could be no application of pure science if the latter did not exist. In point of fact there can be drawn no distinction whatsoever between the alleged two classes of science, for what is "pure" to-day may be "applied" to-morrow, while there is, moreover, only the one scientific method, that of attempted exactitude.

Clements's latest work, "Plant Indicators"*—undoubtedly in a few years to be called "epoch-making"—thus appears at an opportune moment. It has, indeed, the peculiar distinction of being written in the academical lines of pure science, yet its sub-title, "The Relation of Plant Communities to Process and Practice," shows that the ultimate goal of its teaching is the practical application of the principles inculcated in its pages. In short, the production of crops and the proper utilization of certain portions of the natural plant-covering of a country, especially the grasslands and forest, is a striking feature of the book. For this reason an extended notice of the work seems called for in this *Journal* notwithstanding its necessarily popular character.

The author of "Plant Indicators," Dr. F. E. Clements, of the Carnegie Institute of Scientific Research, one of the foremost investigators in plant ecology, has done much to raise that fundamental, but recent, division of botany to the high place it now occupies, and to introduce those exact methods into its technique which are bringing it into line with other exact sciences.

This term "ecology" may need some explanation, since it is a comparatively recent development of botanical science. It may be defined as that branch of botany, or zoology, which deals with the relation of the living organism to its surroundings, these being termed the "habitat." With regard to plants, which alone concern this article, ecology treats, in large measure, of their individual forms as regulated by their environment and of the communities into which nature has placed them, such communities being termed in New Zealand writings, plant-forma-

*F. E. Clements, "Plant Indicators: The Relation of Plant-communities to Process and Practice," Carnegie Institution, Washington, 1920, pp. 388 + xvi, plates 92, text-figs. 25.

tions and plant-associations, as the case may be. Forest, grassland, swamp, salt meadow, and scrub are familiar examples of plant-formations in this country, and of each of these there are distinct classes called plant-associations. In each association one or more species may be dominant — *e.g.*, fescue-tussock (*Festuca novae-zelandiae*) in mountain grassland, rimu (*Dacrydium cupressinum*) in one association of taxad* rain-forest, and raupo (*Typha angustifolia*) in lowland swamp. All plant-associations have a life-history of their own, the different stages of their progression being collectively known as "succession," and the final association being "the climax." The "habitat" consists of the climate and soil, together with the conditions brought about by the plants themselves and the animals with which they are associated. Water, heat, light, wind, nutritive salts, and various kinds of soil are some of the factors regulating the composition of the association and the forms of its members.

The author commences his work with the statement that "Every plant is a measure of the conditions under which it grows. To this extent it is an index of soil and climate, and consequently an *indicator* (the italics are the reviewer's) of other plants and animals on the same spot." Further on (p. 20) it is laid down that "Every plant is an indicator. This is an inevitable conclusion that each plant is the product of the condition under which it grows, and is thereby a measure of these conditions." "The chief objective for the student of indicators," according to the author, "is the cause-and-effect relation, and his chief task to show how effects may be used as signs of their causes." This leads up to the economic significance of indicator work, and the author rightly states that "it is invaluable in land classification, and to the great plant industries, agriculture, grazing, and forestry." And, further, "wherever plants grow in field, forest, grassland, or desert, indicator results are always of some and usually of paramount importance."

This indicator phase of ecology is in its early infancy, and dates only from Shantze's† paper on the indicator value of natural vegetation, published in 1911. Now, though this may be true enough so far as methods of precision go, the significance of indicators had to some extent been recognized in the past, as Clements points out, especially in newly settled regions. In New Zealand, for example, though botany has had little to say in the matter, practice early in the development of the land made more or less use of plant indicators. Thus, manuka (*Leptospermum scoparium*) scrub is considered a sign of poor soil; kahikatea (*Podocarpus dacrydioides*) forest is known to occupy land eminently suitable for dairying; the soil on which taxad rain-forest grows is far richer than that occupied by southern-beech (*Nothofagus*) forest; the monoao (*Dracophyllum subulatum*) indicates the most barren soil of the Volcanic Plateau; the ground occupied by kohekohe (*Dysoxylum spectabile*) coastal forest in the Marlborough Sounds area is well suited for occupation by permanent pasture; wild-irishman

* Taxad rain-forest is the ordinary New Zealand "bush" when one or other of the "pine-trees" are dominant. But these trees are rather yews (*Taxus*) than pines (*Pinus*), hence the more correct term "taxad."

† "Natural Vegetation as an Indicator of the Capabilities of Land for Crop-production in the Great Plains Area," U.S.A. Bur. Plant Industry, Bull. 201, 1911.

(*Discaria toumatou*) in the arid parts of Central Otago is an indicator of rich mica-schist soil, but when growing with greywacke as the underlying rock it denotes barren, stony ground. From the above examples, so readily observed, it seems clear that definite New Zealand research regarding indicators should lead to rich results.

Notwithstanding what has just been said, generally speaking, the time is past for indigenous indicators to be of much use in New Zealand agriculture, though here the indicator method, using the experiences of more than seventy years' farming, and the studying, with an analytic eye, succession in artificial pastures, may well furnish valuable material for advance. On the other hand, the tussock-grasslands of the South Island—semi-virgin as they must remain for many years — can be improved only by the application of methods derived from plant-ecological research, and the recognition of indicators. For instance, the investigation of the Agriculture Department has shown how the intensity of the rabbit pest is indicated by certain stages of depletion and the presence of certain plants, culminating in the appearance of countless circular mats of the scabweed (*Raoulia lutescens*) and its allies. So, too, does the dominance of the blue-tussock (*Poa intermedia*) suggest a totally different treatment as to burning, on account of its higher palatability when not burned, from that of areas where the fescue-tussock (*Festuca novae-zelandiae*) dominates.

Throughout the work under consideration the author insists, as all conversant with his former writings would expect, on an intensive study of succession and on the use of the quadrat method. This latter is the mapping-out of the plant-contents of small areas, and, in experimental quadrats, observing from time to time the changes occurring therein. The experimental areas of the Department on the Dunstan Mountains contain quadrats of the latter category.

Another matter, but one extremely problematical, on which Clements insists (pp. 247–55) is what he calls "climatic cycles." "The best-known and most significant of climatic cycles for the present day is the eleven-year cycle and its multiples," he writes. Further, "the eleven-year cycle is known also as the sun-spot cycle, owing to the striking correspondence with the sun-spot period. The outstanding fact is that our knowledge has reached a point where it seems increasingly possible to employ the sun-spot cycle as a method of anticipating the coincident or related changes in climate and vegetation."

Part III of the work deals with the different kinds of indicators. Here only lime indicators will be referred to. Not so long ago certain plants were considered lime-loving and others lime-hating. This doctrine is well-nigh defunct. New Zealand supplies an interesting example. Sorrel (*Rumex Acetosella*) may be taken as a typical alleged lime-hater, an indicator of sour ground, while white clover (*Trifolium repens*) is a lime-lover. Yet in all New Zealand white-clover seed sorrel is a most common impurity. Sorrel also grows abundantly on extremely fine limestone debris; it is indeed common both on "sour" and "sweet" soils.

Part IV is concerned with an account of the climax formations of western North America. The portions referring to grassland and scrub are especially interesting for comparison with New Zealand associations. Some of the North American grassland plants very much

need introducing into this country, especially for Central Otago. It is astonishing, judging from the photographs, how much alike in general appearance are certain western North American and New Zealand grass and shrub associations.

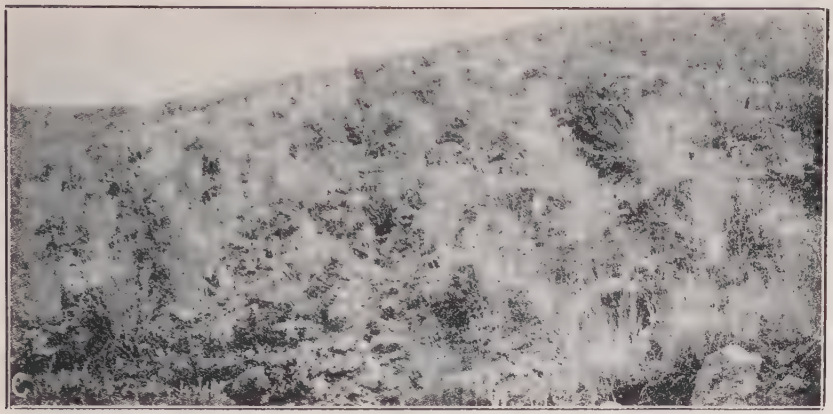
Parts V, VI, and VII, dealing with "Agricultural Indicators," "Grazing Indicators," and "Forest Indicators," which occupy 125 pages, especially concern this article. Leaving the first-named on one side and turning to grazing indicators, it is here that American experience can specially benefit New Zealand, since both regions, with regard to their natural high-land pastures, are confronted with the problem of depletion. So far has America advanced in the direction of its solution that Clements declares that most of the ranges (sheep or cattle runs), where grazing has been administered on the basis of a definite carrying-capacity, have so far regenerated that they have to a large degree recovered their normal carrying-capacity.

As the treatment of grazing indicators occupies sixty-three pages it is impossible to do more than refer to a few points. First of all comes the question of carrying-capacity. This is a more complicated matter than first appears. The author points out (p. 284) that "each kind of stock has its own preferences, as that of cattle for grass and sheep for herbs, while horses and sheep utilize a forage cover much more completely than cattle." This statement that sheep have a preference for herbs is well worthy of testing in New Zealand, for it should not be difficult to add many exotic herbs to our pastures. To a certain extent the foregoing generalization is confirmed by the tussock-grassland investigation of the Department, for it has proved that sheep are especially fond of catsear (*Hypochoeris radicata*), yarrow (*Achillea millefolium*), and hawksbeard (*Crepis capillaris*). On the other hand, but few indigenous herbs or semi-woody plants are eaten, but a notable exception is the anise (*Angelica montana*).

To exactly ascertain the carrying-capacity of the runs is rightly considered of great moment. An actual grazing-test may certainly tell a good deal, but, as the author points out, "so many factors enter into practical grazing that experience alone is not a reliable guide." It must be refined and supplemented by experimental tests under controlled conditions which permit varying one factor, such as grazing type* or kind of animal, while other factors remain essentially the same." Then there is the present carrying-capacity and, what is of more importance, the potential carrying-capacity, the latter being the final aim of improvement in New Zealand, where the carrying-capacity of the primitive grassland was remarkably low. Here also comes in the certain increase in carrying-capacity of much of the summer country if more winter country were available, to say nothing of reducing the snow risk to a minimum.

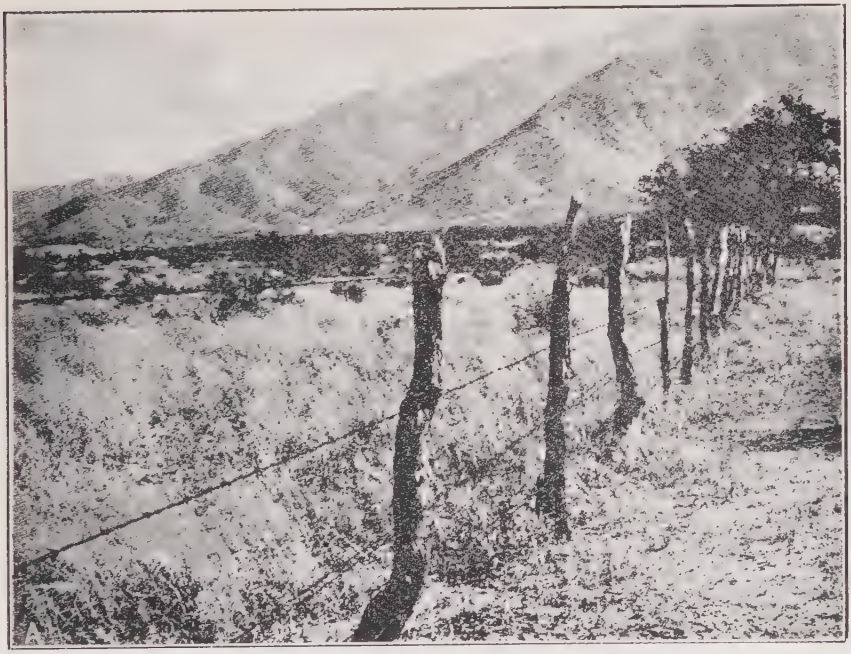
Intimately bound up with the carrying-capacity of a run is the relative palatability of the components of the pasture. This was fully recognized at the very commencement of the Department's investigation. Constant observations have been made in many parts of the South Island of sheep feeding under natural conditions, and experiments carefully conducted. Already much light has been shed on the

* Grass, herbs, shrubs, and trees are different types.



AGROPYRON PASTURE IN OREGON.

Showing great similarity to New Zealand tussock-grassland.



PASTURE IN RANGE COUNTRY, ARIZONA.

Showing protected area on left of fence, and depleted ground on right. Compare with Fig. 7 and other illustrations in article V, New Zealand Tussock-grassland series, in February, 1920, issue of *Journal*.

[*Illustrations reproduced from Clements's work, Plant Indicators.*

relative value of the natural pastures. But the question arises, are these specially palatable plants particularly nutritious? Here the remarks of Clements are full of weight. Concerning certain tables in which the nutrition-content of many pasture plants are given he declares that "differences in palatability are more important than those of nutrition-content. . . . It is surprising to find some grasses which ordinarily are grazed little or not at all possessing as high a nutrition-content as the best species of the range [run]. It is equally surprising to find that many annuals possess apparently a higher nutritive value than related perennial species of much greater grazing-value." When the knowledge of relative palatability becomes more complete it should be possible, with the aid of the quadrat method, to classify the mountain pastures of New Zealand on a palatability basis. The importance of such a result does not need stressing.

The section concerning "overgrazing" is of peculiar interest through the use which can be made of plant indicators to show the exact phase of overgrazing reached. Nothing on this head has yet been published with regard to New Zealand pastures, where the question is greatly complicated by the effect of burning, the depredations of rabbits, and the incoming of pasture-plants more palatable than those of the original grassland. It is easy enough to see that a New Zealand pasture is deteriorating; doubtless there are many indicators of the various stages—*e.g.*, species of *Raoulia*, decrease in size of the tussocks, increase of bare ground, increase of the Maori onion (*Chrysobactron Hookeri*), and increase of certain shrub associations. But aspect plays a notable part with regard to deterioration, so that quite a slight difference may result in a different combination of plants. In any case, indicators will first appear on sunny slopes.

The final section relating to pastures deals with their improvement. This does not concern their replacement by an association more palatable than the original, but a return of the more or less depleted or degraded pasture to its primitive condition, this being assumed to be the best suited to the habitat, as it is a climax formation. This aim is different from that of the research instituted by the Department. Here it was soon discovered that, though the New Zealand climax association might be the best possible when only the indigenous flora was available, a good many exotic plants had entered the community and become as much its members as the original species; while, as for palatability, they are on the whole vastly superior. The aim, then, at present in our tussock-grassland, depleted or not depleted, is to so modify the pasture as to greatly increase its carrying-capacity.

The American plan, as detailed by Clements, a result of many-sided investigations, takes into consideration the following: (1) Proper stocking; (2) rotation or deferred grazing (in New Zealand called "spelling"); (3) eradication of rodents, poisonous plants, &c.; (4) manipulation of the range (run) by clearing, burning, &c.; (5) improving the cover by sowing and planting; (6) forage-development; (7) water-development; (8) herd-management. Contributing factors are found in classification and range surveys, the economic aspects of the ranch system, and an adequate land system. It seems strange to us in New Zealand that the damage done by rodents was not appreciated till 1899. At present, poisoning is considered the only method for their eradica-

tion. With regard to plant-introduction, a certain number of attempts have been made, but so far with little success. There appears nothing equivalent to our surface-sowing.

Finally, there remains for mention the matter of forest indicators. These, according to Clements, are of the following three chief types: (1) Those that have to do with existing forests; (2) those that indicate former forests; (3) those that indicate the possibility of establishing new forests. Both the individual and the community may be taken as indicators. Taking the case of New Zealand, what do our forest communities teach as indicators? Leaving swamp forest out of consideration, there are two main types of forest, the taxad rain-forest and the southern-beech (*Nothofagus*) forest. The taxad rain-forest, in many respects, is akin to tropical rain-forest. Its structure and life-history are altogether different from those of the pine, or deciduous forests of the Old World and America, whence come the practices and art of modern forestry. Obviously our rain-forest must be considered on its merits. Nothing less than an intimate acquaintance with its life-history, not possessed at the present time, together with an ecological classification of its associations and their divisions, will point the road towards its best economic management. So, too, should the southern-beech forests be exhaustively studied in their turn, as well as the connecting-links between these and rain-forest. So from New Zealand studies of New Zealand forests would arise, so far as the indigenous forests are concerned, a true New Zealand forestry.

There are many important subjects in Clements's work not touched on here. The book itself must be read by those interested, and should certainly be in the hands of all who are studying in the field some of the many problems—agricultural, pastoral, or sylvicultural—which New Zealand offers for investigation, and on the successful solution of which the national prosperity to no small degree depends.

Farm-school for Farmers at Ruakura.—A special school for farmers (the second) was held at the Ruakura Farm of Instruction, Hamilton, from 12th to 17th July, under the joint management of the Department of Agriculture and the Auckland Education Board. The school was attended by 82 farmers from various districts, while 30 returned soldiers and 15 cadets in residence at Ruakura brought the total present attendance up to 127. The course of instruction comprised divisions dealing with general agriculture, dairying, live-stock, and wool. Each division proceeded simultaneously, and the attendance was fairly evenly distributed. A popular and very practical extra feature of the school was an hour's daily "round the farm" walk and demonstration, conducted by the Farm Manager, Mr. A. W. Green. In addition to the regular instruction many farmers also availed themselves of the opportunity of consulting with the officers in charge of the poultry, horticulture, orchard, and apiary sections of the farm. Fine weather prevailed during the week, and the whole programme was successfully carried out, the social side being also very happily featured.

SHEEP-MANAGEMENT NOTES.

I. CARE OF EWES PREVIOUS TO AND DURING LAMBING.

F. MACKENZIE, Inspector of Stock, Christchurch.

THE period for which a ewe carries her lamb is about 150 days. Ewes during this period should be kept in ordinary keeping-condition, rich fat-producing foods being avoided as far as possible, especially during the last six weeks of pregnancy. Probably the greatest mistake made by breeders is in allowing their ewes to get too fat at this period, thereby causing such conditions as ante-partum paralysis and eversion of the vagina. These are the two most common diseases affecting in-lamb ewes.

Feeding.—For the proper management of pregnant ewes on arable or partly arable farms a paddock of green feed should be grown, such as oats, vetches, or Cape barley, &c. The ewes should be driven to this feed daily, and allowed to depasture thereon for a short time (not more than half an hour for the first few days), afterwards being taken quietly back to their original pastures. On no account should the ewes be placed on the green feed during wet weather or on frosty mornings, as they are then very liable to get blown (tympanites). Consequently they should be put on the green feed as near midday as possible. During the later period of pregnancy ewes should not be fed on turnips or rape. The worst case of ante-partum paralysis I have ever seen was among a small flock of ewes running on a paddock of old rape, thirty of these ewes dying in two days out of a flock of less than two hundred.

Exercise.—This is another very important factor in the health of pregnant ewes. Where it is found inconvenient to grow green feed owners should see that the ewes are taking sufficient exercise, as when feed is abundant the ewes fill themselves without taking more exercise than they can possibly help, naturally putting on a lot of fat and getting very lazy. This condition is readily observed by seeing the ewes lying about for long periods, and the lazy and listless manner in which they move away when approached by the shepherd or his dog. When such conditions are apparent the ewes should be quietly driven round the paddock several times daily, or driven some distance from one paddock to another. I have seen excellent results from this practice. Naturally when sheep are placed in a fresh paddock they will roam around it, and in this way get the necessary exercise. It will also be found that ewes that have had plenty of exercise rarely have any trouble in lambing, and mortality will be reduced to a minimum.

Lambing.—Immediately previous to lambing the ewes, if possible, should be placed on a clean paddock — that is, a paddock where lambing has not taken place for a few years. The reason for this is that where ewes have lambed the soils may become infected with

material which causes disease. The decomposition of the cleansings, and also diseases which may have attacked lambs and ewes previously, such as navel-ill in lambs, and metritis or septic inflammation of the womb in ewes, leave the soil teeming with disease organisms. On no account should in-lamb ewes be allowed on the ground where tailing and marking has taken place the previous season, as these yards are generally hotbeds of disease-producing germs.

When it is found necessary to assist a ewe in lambing, care should be taken to place her on a clean part of the pasture. The hands should be thoroughly cleansed in water to which a small quantity of disinfectant has been added, and then smeared with carbolic ointment before starting operations.

Saving Lambs.—A considerable number of newly dropped lambs perish owing to violent rain, sleet, and sometimes snowstorms. On small holdings where the lambing-paddocks are convenient to the homestead or other buildings many can be saved. I have found the best method is to place the half-perished lambs in a box or other receptacle in which a liberal supply of chaff (for preference cavings from the threshing-mill) has been placed. The lamb's body should be well covered with chaff, and the head placed on a piece of thin sacking to keep it from getting embedded in the chaff. The chaff seems to absorb all the wet from the skin, and supplies a natural heat to the whole of the body. By this method I have saved hundreds of lambs that were apparently past all hope of recovery, and it will be found much more effectual than and preferable to the general practice of bringing them into the house and placing them near a fire. When the lamb is sufficiently revived to be able to swallow it should be given a small quantity of new milk to which has been added boiled water in the proportion of two parts milk to one part water.

After-care.—Ewes that have lambed should be drafted from the remainder of the flock and removed to better pastures. Ewes with twins should be separated from those with single lambs. The former can be placed with safety on the best pasture available, while the latter should be put on pastures that are less abundant. If this method is adopted much of the mortality among lambs from plethora will be avoided. I quite recognize that it is very difficult to advise farmers on this trouble, as it is the aim of most farmers to fatten their lambs as quickly as possible. However, the disease is entirely due to dietetic influences, and can be controlled only by the restriction of the ewes' diet, thus reducing the secretion of milk for the lambs. The control of the trouble is therefore in the farmer's own hands.

Lucerne-meal of good quality is a highly nutritious stock-food. For calves it can be boiled or steamed with a little ground linseed-meal and added to skim-milk, while for pigs and poultry it can be used as a mash. A sample of lucerne-meal analysed by the Department's Chemist in 1916 gave the following result: Moisture, 13·8 per cent.; ash (including sand, 4·1), 13·4; ether-extract (fats), 1·3; woody fibre, 10·3; protein, 20·6 (equivalent to nitrogen 3·3); carbohydrates, 40·6 per cent. Purchasers should beware of low-quality meal containing a large proportion of woody fibre (stalks).

CULTIVATION OF ROOT CROPS.

AN OBJECT-LESSON AT WERAROA.

W. J. McCULLOCH, Manager, Central Development Farm, Weraroa.

DURING the past season an area at the Central Development Farm was, as usual, devoted to various tests with field roots. Quite apart from the usual comparisons made between varieties, &c., grown in the same field under similar conditions, it was admitted by all who visited the area that the ridged crop of swedes was superior by many tons per acre to the usual flat-sown or broadcast crop commonly seen throughout a large surrounding area of the Horowhenua and Manawatu districts. An extremely interesting comparison was afforded by a crop of swedes on an adjoining property, which was separated from the Central Development Farm field by a wire fence only, being on land exactly similar in quality. This neighbouring crop, however, had been sown on the flat and no opportunity given for intercultivation, consequently the weeds controlled the crop, which would probably yield only one-fifth by weight per acre of that growing within a few feet on the State farm. The great difference in yield was mainly due to the difference in method of cultivation, and certainly not to the quality of the land.

From observation, it is quite evident that in many cases the limiting factor in yield of root crops is lack of proper cultivation. This is especially noticeable in connection with crops on land other than maiden soil, for it is a regrettable fact that local custom in the past has often ignored the root crop as one of the cleaning-crops in a rotation. Thus the old saying, "One year's seeding, ten years' weeding," still holds good, and the weed-seed content of the soil steadily increases. The system of growing crops in rows wide enough apart to intercultivate and control weeds and moisture, as well as to assist the formation of plant-food, was first advocated in Britain by Jethro Tull in the eighteenth century, and this method has long since been proved correct both in principle and practice. A further advantage of ridged root crops is that as intercultivation takes place the raised drills become lowered, leaving the greater part of the root above-ground, and consequently little waste occurs in feeding off.

It has been suggested that the extra expense of ridging and scarifying is excessive, or that labour for thinning is unprocurable. This need not be the case, however, even where the area is greater than can be conveniently dealt with in the ordinary way by hand, if proper implements are used, such as the double-row ridger, double-row scarifier, and double-row thinner, each of which is capable of dealing with over 7 acres per day. In order to show which system will return the greater profit one cannot do better than give a comparison of the direct costs per acre, together with the yields, between

PART OF THE RIDGED AND INTERCULTIVATED SWEDE CROP AT THE CENTRAL DEVELOPMENT FARM.

the ridged swede crop (1) and that grown on the flat without intercutilvation (2), as follows:—

(1.) Central Development Farm swede crop: Ploughing twice, £1 4s.; grubbing twice, 9s.; tine-harrowing twice, 3s. 6d.; rolling, 2s.; ridging (double ridger), 7s. 6d.; thinning (machine), 7s. 6d.; scuffling twice (double scuffler), 15s.; seed, 1½ lb., 5s. 3d.; manure, 3 cwt. superphosphate, £1 7s.: total, £5 os. 9d. per acre. Yield, 50 tons per acre.

(2.) Adjoining swede crop: Ploughing once, 12s.; disking twice, 6s.; tine-harrowing twice, 3s. 6d.; clod-crushing, 2s.; drilling (on flat, 7 in. drills), 4s.; rolling, 2s.; seed, 1½ lb., 5s. 3d.; manure, 1 cwt. superphosphate, 9s.: total, £2 3s. 9d. per acre. Estimated yield, 10 tons per acre.

These figures speak for themselves, and should appeal to any practical farmer. Visiting farmers, indeed, all admitted the force of the demonstration. In brief, the ridging and intercultivation given the Central Development Farm crop paid handsomely. The larger amount of fertilizer doubtless helped the latter crop, but to all who inspected the two crops it was patent that the method of cultivation was the deciding factor between success and comparative failure.

In conclusion, it may be remarked that the foregoing observations refer more particularly to North Island practice.

OIL-SPRAYING TESTS ON APPLE-TREES.

In order to remove the doubt that exists in the minds of a number of fruitgrowers as to what strength oil sprays can be used at with safety on apple-trees in the dormant season, a series of tests was carried out on 22nd August, 1919, by the Orchard Instructor at Motueka (Mr. W. T. Goodwin), using various oils from full strength (neat) up to 1 in 20. The trees operated on were Dunn's Favourite, four years of age. The following is a copy of the Instructor's report:—

These tests were mainly for the purpose of demonstrating to those orchardists in the district who were somewhat hesitant about spraying their trees with oil, 1–8 to 1–12, on the ground that such strengths would kill the trees, that oil could be used with perfect safety at the strengths recommended. In this direction the experiment was conclusive. Those trees sprayed with oil down to 1–4 showed no harmful effects whatever. Of those sprayed with neat oil, in one case only was any damage apparent. This tree lost one or two top buds; the next lower buds, however, came away and made excellent growth. The trees were watched throughout the season, and practically no difference was noticed in the growth made and the general healthy condition of the trees sprayed. The check rows, unsprayed, show a bad infection of San Jose scale. Those trees which were slightly backward at the commencement of the season, through having the stronger applications, caught up on the others during the season, and an average healthy growth of wood, ranging from 2 ft. 6 in. to 3 ft. 6 in. in length, was made throughout the whole test-plot.

DEVELOPMENT OF THE POULTRY INDUSTRY.

SMALL SETTLEMENT AND FEED-SUPPLIES.

F. C. BROWN, Chief Poultry Instructor.

THE writer has frequently advanced the view in the *Journal* that if the poultry industry of this country is to develop and multiply in importance the small settler on the land, conducting the business of poultry-keeping as a side-line, must be chiefly depended upon to produce the necessary eggs and table poultry. Some idea of the weight of this contention may be gathered from a paper on the poultry industry in Ireland read by Miss L. Murphy, Poultry Instructor, Munster Institute, Cork, at the International Poultry Conference held in London last March. Miss Murphy said that, as might be expected in a country of small holdings (out of a total of 572,574 holdings 409,353 are under 30 acres in extent), poultry-keeping forms an important branch of rural industry, and the great bulk of the export trade comes from the small farms and cottages. The poultry industry in Ireland has made such progress that it now furnishes the second-largest item in the country's exports of agricultural products. The export figures quoted for the years 1904 and 1917 afforded a striking comparison, as follows :—

Year.	Eggs.	Value.	Poultry.	Value.	Total Value: Eggs and Poultry.
	Hundreds.	£	Cwt.	£	£
1904 ..	5,470,260	2,188,104	233,525	625,870	2,813,974
1917 .. (estimated)	7,265,000	7,689,000	263,600	1,599,000	9,288,000

Excluding cattle (which rank first), the estimated value of the chief agricultural exports from Ireland for 1917 were: Pigs, £2,172,000; sheep, £2,399,000; horses, £527,000; dairy-produce, £7,987,000.

In view of these statements it may be safely assumed that the poultry industry in Ireland chiefly owes its success to the fact of that country having the great majority of its farmers on comparatively small holdings. It may also be assumed that the majority of Irish poultry-keepers grow most of their own poultry-food requirements, which in itself must be a big factor towards building up the industry. The latter factor is probably the greatest weakness in connection with poultry-keeping in New Zealand. Far too many poultry-keepers, and particularly those who conduct the business as a sole means of livelihood, are usually solely dependent on the general farmer to grow the necessary food-supply. Obviously the expansion of the poultry industry depends on the extent to which the farmer is prepared to perform this service. The position in regard to the poultry-food shortage of late years gives a striking proof of this. Owing entirely to this shortage and the inability of poultrymen to secure a regular food-supply the

industry has received a serious set-back. Laying-fowls have been seriously reduced, while hatching operations have been greatly curtailed.

It will thus be seen that the food question has an all-important bearing on the advancement or otherwise of the industry. Particularly does this apply where poultry is being kept in large numbers on small suburban areas. True, in many such cases highly profitable results are obtained. This is often proclaimed as the amount of money that can be made from poultry from, say, an acre or two of ground, and is also given as a basis on which the industry should be built up. Rarely, or never, however, is any reference made to the area of land required by the farmer to grow the necessary food. In this connection the poultry industry is an isolated one compared with most other industries of the soil. In view of the high prices paid for eggs and table poultry the question is often asked, Why should the poultry industry lag behind the dairy, the fruit, and the bee industries? The answer to this appears to be a simple one—namely, that the dairy cow generally feeds on the food grown by its owner, the fruit-tree feeds from the soil in which it is planted, while the bee, being a free roamer, mostly gathers its food at no expense to its owner. Those concerned in these industries can afford to lean on themselves, whereas the poultryman is dependent on the grain-grower for the maintenance of his flock. It is thus apparent how easy it is for poultry-production under our present system to have its ups and downs. Experience has repeated and will repeat itself in this direction. When fowl-feed is cheap and plentiful the industry advances at a solid rate, while, on the other hand, scarce and dear feed means a check to the industry in spite of the increased prices realized for the more limited production of eggs and table poultry.

In view of this and in face of the present food-shortage it is not easy to see how production can be steadily increased, except by increasing the number of small farms. Such a development would necessarily mean more fowls, the owners of which would be in a position to depend on themselves for the bulk of the poultry-food supply. Poultry-keeping is a most suitable side-line for the small settler, who as a rule resorts to mixed farming. He has many advantages compared with the suburban or semi-suburban commercial poultry-keeper. He has comparatively low-priced land, enabling him to give his birds plenty of range, whereby they secure a great part of their living. The surplus vegetables or root crops, or possibly skim-milk, can be all utilized in reducing the cost of feed for the poultry. There are also other advantages connected with the small-farm system. A small capital only is required at the outset. The poultry brings in profitable and regular returns, while the greater part of the work can easily be undertaken by the women-folk without resorting to hired labour. Farmers' daughters are also given an inducement to remain on the land, thus helping to check rural depopulation.

Generally speaking, the climatic and soil conditions in New Zealand are most favourable for poultry-culture. Heavy-producing stock and the knowledge of how to manage them on proper lines is available to all. Further, the demand exceeds supply, and market prices for the egg- and table-poultry product rule at a remunerative level. Yet in spite of these facts we have sufficient evidence to show that the poultry

stock of the Dominion has greatly decreased during recent years, and that the industry has gone backward instead of forward. It would appear that the solution of the problem depends on the growth of the small-settlement movement and a better assurance of a regular supply of food for poultry.

ORCHARD EXPERIMENTS IN STOKE DISTRICT.

W. C. HYDE, Orchard Instructor, Nelson.

THE following reports give an account of the more important spraying experiments carried out in the Stoke district, near Nelson, during the 1919–20 season:—

1. CONTROL OF BROWN-ROT FUNGUS IN STONE-FRUIT TREES: SELF-BOILED LIME-SULPHUR *versus* LIME-SULPHUR WITH ADDITIONAL MILK-OF-LIME.

This experiment was carried out in the orchard of Mr. T. C. C. Scott, Stoke, on a large block of stone-fruit trees, including peaches—Triumph, Kia Ora, Kalamazoo, Elberta; nectarines—Cardinal, Hunt's Tawny, Lee's Seedling; plums—October Purple and Giant Prune.

Spraying over the whole area was as follows:—

August 19: When the peach-buds were moving and green tips were showing in the plum-trees, bordeaux, 8–6–40.

September 2: When the peaches and nectarines were commencing to blossom, bordeaux, 3–4–40.

For later spraying the block of trees was divided into two sections, A and B.

October 28: "A" section received lime-sulphur, 1–120, plus the milk from 6 lb. of quicklime. "B" received self-boiled lime-sulphur, 8–8–50.

December 5: These respective applications were repeated.

January 10: The whole area received lime-sulphur, 1–120, with milk of extra lime plus tobacco-extract. No later applications of spray were made.

Although the season was rather bad for leaf-curl generally, there was none of this fungus on the experiment block.

The earlier peaches on both sections were very satisfactory; the losses from brown-rot were practically nil. While Kalamazoo peaches in these sections suffered less than 1 per cent. loss, some crops of this variety in the locality were so badly affected as to be not worth marketing. There was moderate infection in the Cardinal and Hunt's Tawny nectarines and Giant Prune, while Lee's Seedling nectarines were badly infected. Late peaches generally were troublesome, and brown-rot gave a good deal of trouble after this later fruit was consigned.

On the main issue—namely, the respective merits of the two sprays—there was little to choose. During the early part of the season they were equally effective, and at time of writing the majority of the trees

on both sections are in excellent condition with an abundant supply of well-ripened wood. Careful comparison of these tests ended in the verdict of equal merit. The lime-sulphur plus milk-of-lime spray has the advantage of being a standard summer spray for pip-fruits generally.

Other points indicated by this experiment are: (1.) Lee's Seedling nectarine is very subject to the attacks of brown-rot—the grower has decided to take out the trees of this variety. (2.) More spraying is required for main crop and late sorts of nectarines and peaches. Packing the crop for spread delivery and export, together with a considerable rainfall, made extra spraying rather a difficult matter; but it is recognized that a couple of extra applications on the later sorts of peaches, as suggested above, are a necessity and well worth while.

2. CONTROL OF LEAF-HOPPER.

This experiment (co-operative) was carried out in the orchard of Mr. O. H. Taplin, at Wakatu. During the previous season leaf-hopper had been very bad in the orchard, particularly in the trees growing near a quick hedge.

A block of forty apple-trees by the quick hedge was sprayed on 7th November with Blackleaf 40 at 1–800 strength. Just previously they had been sprayed with lime-sulphur and arsenate of lead. On 28th November the whole of the orchard (with the exception of some young Sturmer trees) was sprayed with lime-sulphur 1 gallon, arsenate of lead 3 lb., and Blackleaf 1 pint to 100 gallons water. This was repeated on 23rd December. When inspected at this time the block of trees sprayed on 7th November was free from this insect, in spite of the fact that the hedge close by was badly infected. The remainder of the orchard was only slightly infected, except the unsprayed Sturmers, which were decidedly worse.

The last spray was repeated on 2nd February, and an application on the Sturmers only was made on 5th March.

In April there was a fair amount of leaf-hopper on some trees, but nowhere was it serious. The block of trees which had received the first application was decidedly cleaner than the remainder. The experiment indicates that if tobacco-extract were used with the early calyx-spray, and afterwards as necessary, this insect would be kept under control. By this means the first hatch is caught in the nymph stage.

[NOTE BY DIRECTOR, HORTICULTURE DIVISION. — Excellent results were secured in Canterbury by using lime-sulphur, 1–80, at the fruit-set period, in addition to later sprays mentioned in this report.]

3. CONTROL OF BLACK-SPOT FUNGUS.

This demonstration was carried out by the Stoke Fruitgrowers' Association in co-operation with the Horticulture Division, in the orchard of Mr. A. Gilbert, Stoke. The trees consisted of a block of pears, including the varieties Williams' Bon Chrétien, P. Barry, and Winter Nelis.

On 4th September, when the buds on some varieties were just beginning to move, bordeaux, 8-6-40, was applied; on 21st September, when the blossoms were breaking, bordeaux, 6–4–50; on 9th–17th October,

bordeaux, 3–4–40, the fruit having then set. This application was repeated on 1st–13th November.

On 27th November lime-sulphur 25°, 1–100, about 1–130 standard strength, and arsenate of lead, was applied. Several applications of this mixture were subsequently made at intervals of about a fortnight. This is the standard summer spray for pip-fruits in this orchard.

The result was a very fine sample of bright fruit, with a small percentage of rejects. The fruit was practically free of black-spot right through the block. In previous seasons the bulk of the crop was unsaleable.

Club-root Contagion. — An interesting case bearing on this subject came under my notice during the past season. A farmer put two paddocks, about 100 acres, into turnips and swedes. No. 1 had been previously cropped, but No. 2 had never previously been ploughed. No. 1 was on the higher land, and running through were two depressions which carried off all flood-water and acted as surface-drainage channels for this paddock. These channels continued through No. 2 for a considerable distance. The soft turnips in No. 1 paddock were badly affected with club-root, also the swedes in No. 2 wherever they came under the influence of the flood-water, while the roots in the rest of the field were healthy, showing that the contagion had been carried by storm-water from field No. 1 to field No. 2.—*J. W. Deem, Fields Instructor, Wanganui.*

Wild White Clover.—Replying recently to a correspondent the Biologist (Mr. A. H. Cockayne) gave the following information on this subject: Certain lines of white clover grown in the Hawke's Bay District are sold as wild white clover. Such seed is derived from long-established rye-grass pastures, and is for the most part dressed out of perennial rye-grass seed crops. In very old pastures the clover that persists is looked upon as being more or less naturally selected, the shorter-lived strains going out in the early years of the pasture. Just how far the persistence of the clover is due to reseeding and not to propagation by vegetative stools I am not prepared to say, but there can be little doubt that the clover in such permanent pastures is kept going by a certain amount of natural reseeding. It is, of course, quite reasonable to expect that such plants would undergo a process of natural selection. Nearly all imported white-clover seed is harvested from crops that have not been sown longer than two years, and there certainly have been instances in New Zealand where such seed has produced plants that do not remain permanent. I should not, however, recommend the purchase of imported wild white clover, as it is exceedingly expensive, being about £1 10s. per pound. There is no doubt that the local white clover dressed out of old-pasture rye-grass is exactly the same as European wild white, and the price is very much cheaper.

AGRICULTURAL COMPETITIONS.

SOME TARANAKI ACTIVITIES.

J. W. DEEM, Fields Instructor, Wanganui.

To the *Journal* for last September I contributed a brief account of these competitions, in the hope that it might stimulate interest and be the means of other districts taking them up. I am glad to say that several other localities between New Plymouth and Palmerston North are starting similar competitions, and from the inquiries I have had from outside my district it would appear that the idea is spreading. One may expect, therefore, that it will not be long before this most useful means of agricultural education is fairly general in all up-to-date farming districts of the Dominion.

By those who have given the question any consideration it will be recognized that in most districts there are farmers who are quite at the top of their vocation. These men are generally busy, and most of their time is taken up looking after their own farm-work; consequently they have little time to spend advising their neighbours who are not so well up in farming operations. Again, many farmers are somewhat sceptical of big returns from hearsay. Therefore any means that will spread the knowledge of the really good farmer among his less experienced neighbours in a practical and impressive manner must be of valuable service to a district. In this direction the field competition quite "fills the bill." The farmers are able to accompany the judges from field to field, see the crops for themselves, and inquire into methods of cultivation and manures. Further, as full particulars are compiled and kept, they may refer to these at any time to refresh their memories. The inspection of a good crop and obtaining all particulars as to how it was grown must be a great incentive to the indifferent farmer to improve his methods.

One of the districts in Taranaki which has recently taken up these competitions is Otakeho. Here the local branch of the Farmers' Union decided to hold competitions in the growing of lucerne, mangolds, carrots, and swedes. The members of the branch took the matter up with great enthusiasm, and the competitions were keen. The lucerne was judged at the end of January last, and the root crops in May. From fifty to sixty members of the union accompanied the judges, saw the crops judged, and entered into a general discussion on agricultural matters. The lucerne was judged on points, the awards notified before leaving each field, and a short discussion invited, so that any points in favour of or against the methods adopted on each particular farm could be gone into on the spot. The first prize in this competition was won by the oldest stand competing, and the only one that had been put down with inoculated soil. This crop had 3 cwt. of superphosphate applied at time of sowing, and was top-dressed with a further 3 cwt. per acre last spring.

The best mangold crop at Otakeho weighed 66¾ tons per acre, and the poorest 22¼ tons. In swedes the best crop was 45¾ tons, against 28¼ tons for the poorest. Points strongly emphasized were the advantage of sowing mangolds in wide drills and giving intercultivation by means of the horse-hoe. The three placed crops were sown in 28 in. drills. The advantage of early ploughing for swedes was very apparent at Otakeho, as in other districts. The winner ploughed in August, the second-prize winner in October, and the other competitors at various dates in November. The winner (Mr. Rushin), who is recognized as a good farmer, in returning thanks on being presented with the first prize, said that early ploughing and thorough cultivation had been the secret of his success. He also said that it was strange, but no less a fact, that his neighbours on the north and south were placed second and third. He thought they must have been looking over the fence.

As further emphasizing the educative value of these competitions it may be pointed out that this year members of the Toko Settlers' Association (a very active body as regards field competitions) won first and second places in the Taranaki Agricultural Society's swede acreage competition, against strong competition. Toko also won the Taranaki District swede acreage competition for the best three crops. Members of this association made eleven entries at the New Plymouth winter show, securing five firsts, five seconds, and one third.

WOOLLY-APHIS CONTROL TESTS AT PAPANUI.

G. STRATFORD, Orchard Instructor, Christchurch.

EXPERIMENTS for the control of woolly aphis during winter and summer were carried out at the Papanui Experimental Orchard during the past season. It was intended to compare results between two sprayings with red oil at strength 1–8, during June and August, and one spraying at strength 1–8 during August, but on account of the non-arrival of the spray-pump the June sprayings could not be carried out. The following are particulars of the tests and the results obtained :—

WINTER CONTROL.

1. *Red oil, 1–10, heated to 120° F.*—Four Rokewood trees badly infested with aphis were selected for this test, the spray being applied on 17th July, 1919. An examination of the trees was made on 9th October, when it was found that the results were very satisfactory, the trees being practically free from aphis. A final examination was made on 24th February, 1920. A few colonies of aphis had established themselves during the season, these being chiefly on the new growth, but the main parts of the trees were very free from infection.

2. *Red oil, 1–1, heated to 120° F.; painted.*—Painting was done on 18th July, on Rokewoods, treating only the parts affected with aphis. Trees were examined on 9th October, and again on 24th February.

Aphis was well controlled in the parts painted, a small percentage showing round the edges of the older knots at the final examination. A good many colonies were to be found on the young shoots. One tree was painted all over with the oil at strength 1–1 heated to 120°. No apparent damage was done to any of the buds, and the tree blossomed at the usual time, setting out an average crop of fruit. At the final examination, on 24th February, this tree was practically free from aphis, very little showing in the young growths.

3. *Red oil, 1–1, cold; painted.*—Rokewoods; bad with aphis; painted 18th July, on affected parts only. Examinations on 9th October and 24th February. Aphis was considerably checked by this application, but results were not as good as when heated oil was used.

4. *Pomsol, 1–1; painted.*—Four trees slightly affected with aphis; affected parts painted 9th July. At examination on 9th October there was practically no aphis showing, but it began to appear as the season advanced, and at the final examination on 24th February the trees were considerably affected where painting had been done.

Summary.—Spraying with red oil at strength 1–10, heated to 120°, gave the best results, and in my opinion this is worthy of further tests. Painting with red oil at strength 1–1 was fairly good in control, but considering the time taken it does not compare favourably with the heated spray at 1–10. Pomsol did not appear to last on the trees as long as the red oil, and therefore was not so effective.

SUMMER CONTROL.

1. *Blackleaf 40, at strength 1–800.*—One row of apples was sprayed on 12th December, aphis showing at time of application. Examined one week after spraying; practically no aphis showing. Examined again on 11th January, when quite a number of colonies had established themselves not only on the young wood, but also on the older parts that had received attention when spraying. Trees were again sprayed on 12th January. This spraying kept the trees free from aphis for a longer period, but on examination on 24th February quite a lot of aphis was found.

2. *Blackleaf 40, plus lime-sulphur 1–120.*—Sturmers were sprayed on 9th December, when quite a number of colonies were present. This spray was very effective, keeping the aphis in check for some time. Sprayed again 12th January. Final examination showed much aphis in all parts of the trees—more than on trees where Blackleaf 40 was used alone. There was no detrimental effect on the foliage with this spray.

3. *Pomsol, 1–40.*—One row of Sturmers was sprayed on 28th January, there being a fair amount of aphis at time of spraying. The spray washed the aphis off where struck, but it soon returned and increased during the season. This treatment was not effective in control.

4. *Pomsol, 1–60.*—Same result as in No. 3.

Summary.—Blackleaf 40 gave the best results, keeping the aphis in check longer than other sprays used, although it was only a temporary check. There appeared to be no advantage in adding lime-sulphur to the Blackleaf. The results from using Pomsol were less satisfactory.

FARMERS' RESPONSIBILITIES WHEN GRAZING STOCK FOR REMUNERATION.

A. D. PARK, A.I.A.N.Z., Wellington.

A BAILMENT is a delivery of goods in trust on a contract expressed or implied that the trust shall be duly executed and the goods redelivered as soon as the time or use for which they were bailed shall have elapsed or be performed. The person who receives the goods is styled the bailee, and the person who delivers them the bailor. Where a bailment is for the benefit of both the bailor and the bailee the latter is liable for *ordinary negligence*, which is usually interpreted to mean the omission to take the same care as every man of common prudence takes of his own property.

A species of bailment commonly dealt with by farmers is that known as agistment, which is a contract to take in stock to graze on the farmer's own land for reward. Such contracts are as a rule entered into verbally. The person on whose land the stock are grazed has a sufficient interest in them to proceed, civilly or criminally, as the case may be, against any third person who interferes with them or takes them away. In the absence of a special agreement he has no right of lien upon them for his charges, and, moreover, he must exercise reasonable care in dealing with such stock when committed to his care, as he is liable for negligence. The amount of care required is a question of fact, and depends upon the particular circumstances of each case. No general rule is laid down as to what constitutes negligence, but, as stated above, all that can be demanded is the display of a reasonable amount of foresight so as to guard against avoidable dangers. Thus, stock would require to be properly fenced in to prevent them from straying. If the stock is stolen without any negligence on the part of the bailee he cannot be called on to bear the loss sustained.

The law in New Zealand provides that every person who drives or removes any stock from any land not in his own occupation without the consent of the occupier of such land is liable to a fine not exceeding £100, or to imprisonment for a period not exceeding twelve months (*vide* section 59 of the Stock Act, 1908). It is further provided that any Inspector of Stock may, if he thinks fit, on the application of any owner of stock who has reason to believe that any of his stock have strayed to and upon any land occupied by any other person, by notice require such occupier to muster his stock, or, in the case of not being an owner of stock, to allow such stray stock to be mustered in a yard or pen on a date to be named in such notice for the purpose of delivering over such stray stock to the owner thereof. Every such occupier who refuses or neglects to comply with any such notice from the Inspector is liable to a fine not exceeding £20 and not less than £1. The Inspector may, if he thinks fit, on the application of such occupier, postpone the time fixed in the notice for the mustering and delivering of such stock, and the occupier is entitled to recover from the owner any reasonable expenses incurred in mustering the stock or delivering stray stock, as well as compensation for any unavoidable damage caused in so doing (section 56).

In the case of a farmer who takes in stock for grazing and such stock are stolen while on his land, it would be considered his duty to notify the police or the owner, so that steps might be immediately taken for their recovery.

An interesting case—Coldman *v.* Hill (35 T.L. Rep. 146)—which illustrates this was recently heard in England. The facts were that Hill, the defendant, was a farmer who took in cattle for pasturing, and in the spring of 1917 took in some cows belonging to the plaintiff. On 6th June two of the cows were reported to him by his stockman as missing. On the following day the stockman was told that two men had been seen driving the cows away about midday on 5th June, and he reported this to the defendant. The defendant did nothing, and did not communicate the loss to the police, nor did he inform the plaintiff. He was under a belief that the plaintiff himself had taken away the cows, as he had already said he would do, but the defendant wrongly assumed that he already had done so. The cows were, in fact, stolen, and the plaintiff was not informed that his cows were missing until about three months after.

The County Court Judge, who first heard the case, held that up to the time of the theft the defendant had not been negligent, but that he was negligent in not communicating with the police or the owner when his stockman reported to him the fact that the cows were missing. The question then arose, Did this negligence lead to the loss of the cows? Usually the plaintiff has to prove the negligence he complains of, and he must also show that such negligence caused the loss. It was contended for the plaintiff that it was for the defendant to show that even if he had communicated at once with the police there was not any reasonable chance of the cows, or their value, being recovered from any one who had taken them. It makes, of course, a great difference which of the parties at law has to take up this burden, or onus of proof as it is called. The Judge found there was no reasonable doubt that when the cows were missing they would have been recovered if the defendant had communicated with the police, and he gave judgment for the plaintiff. The defendant appealed to a Divisional Court, which reversed the County Court judgment, holding that there was no evidence on which the County Court Judge could find that the cows might have been recovered, and in any case that the damages alleged to be caused by the defendant's negligence were too remote to be recovered. The plaintiff then took the case to the Court of Appeal, with the result that this Court gave the same judgment as the County Court Judge and reversed the decision of the Divisional Court, it being held that though the cattle were temporarily out of the custody of the agister (the bailee) they may not have been completely lost, and he could, by taking some step which a reasonable man would take, have restored them to his custody and so prevented the completion of the loss, and such a step it was his duty to take.

At the head of all sciences and arts, at the head of all civilization and progress, stands, not militarism, the science that kills; nor commerce, that accumulates wealth; but agriculture, the mother of all industry and the maintainer of life.—*President James A. Garfield.*

WORK FOR THE COMING MONTH.

THE ORCHARD.

REPORTS relative to the fruit shipped to England during the month of April last indicate that the whole of the shipments, with the exception of the first small consignment of pears, arrived in good condition, were well received and commented upon by buyers, and brought top control prices. This should secure to shippers very reasonable net returns per case.

In the circumstances it is a great pity that more was not made of the opportunity to export. Had this been done many of the present holders of fruit in cool storage would have correspondingly less cause to worry over future prices than they have at the present time. However, the Department, at the request of the Fruitgrowers' Federation, which was anxious, if possible, to relieve the situation here, sought information by cable from the High Commissioner, London, as to the prospects of New Zealand apples on the English markets during the months of September and October. The reply, although somewhat late for the purpose, is interesting, as follows:—

"With reference to your telegram of 8th July respecting apples: Prospects generally are regarded as good for Sturmers and Delicious arriving in September–October. English crop this season is expected to be light, and it is understood imports from America are being recommended. Food Controller has suspended price restrictions from 1st August to 14th November, so that imports and home supplies during that time will enjoy free market. New Zealand shippers should not send apples over $2\frac{1}{2}$ in. or $2\frac{3}{4}$ in., and provided fruit is in good condition and arrives sound it should command present control figure. From 15th November control will be reimposed, price being based on maximum of 10d. per pound retail. Would be glad to receive early advice of intended shipments, and to learn if these will be made under usual Government guarantee of 1d. per pound."

—*J. A. Campbell, Assistant Director of the Horticulture Division.*

AUCKLAND.

Spraying: Peaches, nectarines, and plums should be sprayed just as buds commence to burst, with bordeaux, 8–6–40, for control of fungoid diseases, including leaf-curl, shot-hole, rust, brown-rot, and bladder-plum. It is desirable that this spray should be put on as late as possible before the blossoms actually burst.

It is possible that the cold snap experienced in July will have caused later bud-movement in pip-fruits. At any rate, it is to be expected with many varieties of apples, and in this case the dormant red-oil sprayings for control of sucking-insects which have not yet been applied may be carried out during the first week in September, where no bud-movement is noticeable, at 1–15 on apples and 1–17 on pears. Red mite on apples is rather much in evidence in the Auckland District this year, consequent upon the dryness of last summer, and on this account the oil should not be missed.

Spraying for black-spot and other fungoid diseases must receive earnest attention as the blossom-buds commence to swell, using bordeaux, 8–6–40. This must be followed in pears and all varieties of apples subject to black-spot with bordeaux, 6–4–50, at the cluster-bud stage. Many growers with as many as ten to twelve varieties of pears and apples make one spraying suffice for each of these applications. When it is noticed that one or two, or maybe three, varieties have reached the correct stage, the whole block is sprayed then and there to "save trouble," whereas there is no surer method of inviting trouble in a pear

orchard in an average season. My experience in the Auckland District goes to show that the pear-grower who sprays each variety as those trees reach the proper stage obtains good results, amounting even in a bad season to 90 per cent. of clean fruit.

Citrus fruits: The growth of all classes of citrus fruits is somewhat irregular this year on account of the abnormal weather conditions of the past twelve months. Growers must watch the opportunity to put on bordeaux, 5–4–40, either before the early spring growth commences or when it is sufficiently hardened. If verucosis is prevalent and a good setting of fruit has been obtained, in cases where the young growth has not hardened a weaker bordeaux spray (4–4–40) may be applied as soon as blossom-petals have fallen.

Cultivation: As soon as prunings have been cleared up and early spring sprayings completed manure should be applied, and ploughing may then be proceeded with, followed by any digging that may have to be done. Owing to the present high cost of labour for orchard-work it is advisable to plough up to as near the trees as possible, using extension bridles to the plough, and orchard harness with rope or leather traces. Ploughing close in to the trees must be shallow to avoid loss from damaging feeding-roots. All ploughings should be completed before the spring growth of clovers attains its height.

Manuring: Although artificial manures are very high in price this season, neglect to apply them only results in a lesser production and eventually soil-depletion. It is bad policy to spare the manure, whatever the plant may be.

Grafting: It is usually found that some attention is required in every orchard in this respect. The work of cutting down all trees for regrafting should now be completed, and scion wood procured without delay. Grafting requires to be done when the sap is rising, in order to ensure a ready lifting of the bark-tissues and an immediate flow of the necessary sap from stump to scion. The first two weeks in September will probably be the best period for grafting this season.

—*J. W. Collard, Orchard Instructor, Auckland.*

HAWKE'S BAY.

All prunings should now be gathered and burned, planting finished, and the land spring-ploughed. Towards the end of the month the bark of the apple and pear will be in a pliable condition, and grafting may then be done.

Stone-fruits should be sprayed with bordeaux, 8–6–40, for leaf-curl, pocket-plum, rust, &c., as the buds are bursting. Black aphis may be controlled with Blackleaf 40, ½ pint to 50 gallons, with 1½ lb. of soap as an adhesive.

For the treatment of black-spot bordeaux is the preventive to be relied on, and must be applied at the correct stage. Though there are certain varieties which rust badly if bordeaux is applied too late, all varieties will benefit by an application if applied before open-cluster. For working convenience apples and pears should be divided into three classes and treated as follows:—(1.) Apples and pears not subject to russet: Early bud-movement, bordeaux, 8–6–40; early bud-movement to green-tip, oil, 1–17; petal-fall, bordeaux, 3–4–50. (2.) Apples and pears inclined to russet but not badly, such as Dunn's, Statesman, Cox's, Adams', and all true russet varieties: Early bud-movement, bordeaux, 8–6–40; early bud-movement to green-tip, oil, 1–17; open-cluster but no colour, bordeaux, 6–4–50. (3.) Badly russeting varieties, with tender skin, also subject to powdery mildew, such as Jonathan, Cleopatra, Sturmer, and Josephine: Early bud-movement, bordeaux, 8–6–40; early bud-movement to green-tip, oil, 1–17; open-cluster, lime-sulphur, 1–30. With class (2) the application of a second coat of bordeaux is a good safeguard and ensures the full effectiveness possible at this period without the danger of russet. With class (3) bordeaux at open-cluster is risky, and as there is powdery mildew to consider, lime-sulphur is substituted to serve a dual purpose.

Red mite: It will be noted that with the various apples and pears, regardless of the russet class, an application of oil is advised at bud-movement even as late as green-tip. At this period the maximum efficiency of control against the various insect pests is assured, while the general effect on the eggs of red mite is such that the hatching-time is retarded considerably, and the trees are safeguarded from the injurious effects of early insects at the critical time — the flowering-period. The control of red mite depends in no small measure on the orchardist becoming acquainted with the hatching-time. This varies with locality and season, so a close watch must be kept, particularly on the imperfect leaves

found on fruit-spurs throughout the lower framework of trees. Once the mites become active they can be killed with lime-sulphur, 1–100, which should be applied at frequent intervals—say, every eight days—in order to catch delayed hatchings. Control later in the season will depend a good deal on the thoroughness of these early applications, as insects escaping will deposit summer eggs to hatch out later. —*W. H. Rice, Orchard Instructor, Hastings.*

NELSON.

Towards the end of September the apple-trees will commence to swell their buds; the pear-trees are rather earlier. The general pruning should be completed before these dates. Considering the prevalence of bitter-pit in apples, and its relation to pruning, growers are recommended to consider McAlpine's fifth report on "The Cause and Control of Bitter-pit." Mr. McAlpine considers pruning a prime factor in the problem.

Carefully label and heel-in scions for grafting later in the month, or, better still, in early October, when growth commences.

A clean crop depends chiefly on proper spraying at this season; for stone-fruit and pear-tree spraying see last month's notes. Apple-trees will require the application of a fungicide early in September, while the trees are dormant. Lime-sulphur, 1 gallon to 10 gallons water, is the popular spray at this season. Apples specially subject to black-spot are best sprayed with bordeaux, 8–6–40, instead. Trees infected with scale or aphis, &c., should have the above fungus-spray followed with an application of red oil, 1–15 or 1–20, the weaker mixture being used if the buds have commenced to swell. Lemon-trees affected with black scale should be sprayed with red oil, 1–40.

The heavier orchard lands will be ready for ploughing during September. Take the first opportunity of turning them over, carefully burying any cover-crop and disking down the slices without delay. A good job chiefly depends on doing the work when the soil is sufficiently dry; do not be tempted to start before. Use a special plough for working round the trees, and a light double-furrow implement for ploughing the centres. See last month's notes regarding liming and manuring.

An inspection of fruit cool stores at the present time is of great interest. It is said that "experience teaches," but much depends on the student, his powers of observation, and the practical application of the knowledge gained. Much of the fruit in cool stores is unsuitable for long storage. Considering present-day costs it is unwise to store the larger-sized apples—dessert varieties over $2\frac{3}{4}$ in.—particularly Jonathans. The sooner such lines are quitted the better.

—*W. C. Hyde, Orchard Instructor, Nelson.*

MOTUEKA.

Spring ploughing and general cultivation should be kept well in hand. Manurial treatment where required should be attended to, and the manure turned under with the plough. All prunings should be gathered and burned.

This month will be one of the busiest, if proper attention is given to the requirements of the orchard regarding the control of disease. The main work will be the early spring sprayings for the control of fungus diseases. For the early sprays, bordeaux, 8–6–40, should be applied when the buds show colour. This spray will be found most effective for control of leaf-curl and shot-hole fungus on stone-fruits. The same strength of bordeaux applied to apples and pears when the buds are bursting will greatly assist to control black-spot. At the later pink stage (just when the blossoms show pink) bordeaux, 6–4–50, should be applied to pears.

Lime-sulphur (preferably home-made) may be used at the latter stage on apples, at a strength of 1–25 to 1–30. Lime-sulphur should be tested with an hydrometer, and when testing under 33° Beaume it should be prepared and diluted according to the table published in the Department's Bulletin No. 82, so as to make a standard strength. A copy of the bulletin is available by application to the local Orchard Instructor. Good results were obtained by many orchardists in this district last season by a continued application of lime-sulphur throughout the season, weakening the applications as the trees advanced.

Where the oil spraying for control of insect pests has not yet been applied, this should be done early in the month at a strength of 1–12.

Grafting may be undertaken towards the end of the month.

—*W. T. Goodwin, Orchard Instructor, Motueka.*

CANTERBURY.

Another reminder to gather up and burn all prunings will not be out of place, as so many growers are apt to leave these lying about for a great portion of the season, thus interfering with cultivation and also possibly acting as a source of infection to the fruit-trees. Planting of young trees should be finished in the early part of the month if good results are to be expected from the first season's growth.

Manuring, if necessary, should claim the attention of the orchardist at this time of the year, especially in cases where heavy crops are taken off the trees annually. No doubt an application of well-rotted stable manure would fill the bill better than anything, but as in the majority of cases this is unprocurable a good dressing of artificial manure will be found beneficial. Blood-and bone has proved very successful in orchards in this district, spreading it broadcast round the tree and hoeing it under the surface.

Green crops sown in the autumn will require to be ploughed under during the month, taking care to see that the entire crop is buried. It is advisable to leave any further cultivation for a time, thus giving the green crop turned under a chance to rot. Spring ploughing should be done as soon as possible. Much of the success of the orchard depends on the condition of the soil at this time of the year; therefore it is advisable to give every attention. Break down the ploughing by means of the cultivator or harrows, and so reduce the soil to the fine tilth necessary for conserving the moisture throughout the season.

As stated last month, spraying will be the chief work of the orchardist at this season, and the recommendations given still apply. The mixing of sprays is most important, especially when using bordeaux, the real efficiency of the spray depending on the manner of blending. Much also depends on the time of application. The different varieties in the orchard are not all ready for a certain spray at the same time, therefore trees should be studied and watched as regards spraying right from the bud-movement period, and the different sprays for different periods applied at the proper time. Spraying done at the wrong time might just as well be left undone, as it only results in a waste of good material.

—G. Stratford, Orchard Instructor, Christchurch.

OTAGO.

In last month's notes the sprays for insect pests and also for the fungus diseases of stone-fruits were dealt with. The next consideration is the sprays for fungus diseases on pip-fruits—black-spot of the pear and apple, and powdery mildew of the apple. The former disease does not yet concern Otago Central growers, but the Teviot district is slightly troubled with it, and the disease gets worse in the lower country where the rainfall becomes greater. The past season was a comparatively good one, black-spot causing very little trouble except in odd instances, but growers must not relax their efforts. Bordeaux is the best preventive for this disease, and is best applied when the blossom-buds have just emerged but are not yet showing pink, at 6–4–40; and again in the pink stage, 3–4–40, about a week to ten days later, bearing in mind that all varieties do not blossom together, and that to get the maximum results each variety must be treated as the right stage is reached. When the blossoms are showing pink the mixture must be reduced to 3–4–40, and tested with litmus paper to make sure it is a neutral mixture not showing any acid reaction. Be sure the lime is fresh slaked, and do not allow the bloom to get too forward.

The foregoing remedy is the best for pears, but the varieties of apples must be taken into consideration because of the susceptibility of some to russeting. The following varieties are very liable to russet and crack with the two applications of bordeaux given above, and should not receive the mixture after the early stage: Adams' Pearmain, Jonathan, Gravenstein, Ribston Pippin, Cornish Aromatic, Sturmer, Scarlet Nonpareil, Shepherd's Perfection, Dunn's, and Cox's Orange. These should receive lime-sulphur, 1–50, at the pink stage in preference to the second application of bordeaux. The four last-named are the better for lime-sulphur treatment at both stages, first at 1–20, and secondly at 1–50. For powdery mildew lime-sulphur is the best remedy, and the disease must be tackled early, first at green-tip stage, 1–10, followed at early pink stage, 1–30, if delayed, reducing to 1–40–50 as blossoming advances. All mildewed tips should be cut off and burned when noticed on the trees. All subsequent sprayings will be confined to sulphur compounds, particulars of which will be dealt with in future notes.

Growers desirous of regrafting apple-trees will find the second week in September the best time to do this. Stone-fruits must be done fully a month earlier than pip-fruits. These dates apply to Central Otago; the Taieri district will be quite three weeks in advance. Test the stocks to be regrafted, and insert the scions as soon as the bark parts freely from the stock.

—J. H. Thorp, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

HATCHING FOR PROFIT.

As September is the best month for hatching out the popular White Leghorn it is obviously the period in which the great bulk of incubating and brooder work must be carried out. While this is mentioned as the most desirable time for the White Leghorn, or indeed any of the lighter breeds, there is no objection to continuing the hatching during the early part of October; the end of September, however, is certainly better. The greatest drawback in prolonging the hatching-period is that too many late-hatched pullets are produced, and those seldom lay in the winter, and are therefore not profitable stock. The wise poultry-keeper aims at securing all his chickens during two months—August and September—instead of extending it over a period of about six months, which is often the case. It is not sufficient to have only a proportion of the pullets laying when eggs are worth most money. The great majority of the pullets must be producing dear eggs if the true profits are to be secured from the business. It should be remembered that one egg in winter is worth more than two in summer, and it is the early-hatched pullet that produces the dear egg. No time therefore should be lost in getting the full complement of chicks hatched out.

Unfortunately, many who depend on the natural mother are forced to hatch late owing to their inability to secure broody hens. One means available to the small poultry-keeper for overcoming this difficulty in timely hatching is the present facility for securing day-old chicks from reliable specialists in the production of heavy-producing stock. Such chicks can be satisfactorily brought to maturity with a fireless brooder, provided the necessary attention is available.

BROODING-POINTS.

In artificial rearing the importance of preventing the chickens from being chilled cannot be emphasized too strongly. The most common cause of chill is subjecting the chick to extremes of temperatures. It is therefore essential that they be carefully watched in order that the degree of warmth shall be at all times favourable to their development. As to the temperature to be maintained in the brooder, there is no better guide than the behaviour of the chicks. If they be well spread out and look comfortable it may be taken for granted that the heat being maintained is correct. On the other hand, if they are seen to be huddling more warmth is required; while if the heat be too great they will be gasping for breath, with wings spread out to a lesser or greater degree, and thus when they leave the brooder they are highly susceptible to chill.

In addition to having the right degree of warmth, the brooder must be arranged in such a way that pure fresh air is available to the chicks at all times. Stuffiness must never be allowed to exist, or the mortality will be great. An experienced person can tell at a glance by the appearance of chicks when they leave the brooder in the morning if the ventilation is sufficient or not. If it is observed that the youngsters come out bright and active and are keen to exercise it indicates that sufficient fresh air is available. On the other hand, if they come out dull, and brighten up during the day, it may be taken for granted that the night conditions are not what they should be and that more fresh air is necessary. No matter whether it be with a heated or fireless brooder, the provision for the admittance of an ample supply of fresh air is an all-important essential.

Do not be in a hurry to feed the chicks after they are first placed in the brooder. Plenty of sleep and a comfortable degree of warmth is of more importance than food. As to feeding, some breeders prefer giving all wet mashes, while others feed a mixture of dry broken grains. Both systems have their advantages, and what to feed largely depends on circumstances. Where the broken grain is used better results will be secured if it is moistened and allowed to swell before being feed, particularly with young chicks.

Do not neglect to pay strict attention to cleanliness in all things connected with brooding operations. The brooder must be frequently cleaned, and it should be sprayed with disinfectant before a fresh lot of chicks is placed in it.

After the chicks are three days old they should not be permitted to acquire the habit of remaining too long in the brooder during the day. On the contrary, they must be induced to exercise as much as possible, for the great value of exercise for promoting health in chicks cannot be overestimated. A good plan is to lightly cover the brooder-runs with straw chaff, and scatter in this some finely broken grains. Hulled oats make a fine scratching-food, and there is nothing better for promoting a healthy growth in chickens of all ages.

Always open up any chicken that dies, in order to discover if possible the cause of death. Recently I was asked to advise in a case of continual deaths of chickens, and, on examination, observed that the gizzard was packed with small pieces of shiny grit, which they could not get rid of, and therefore died of starvation. On my advice sea-shell was used for grit with the next lot of chickens hatched. Now I am informed that the chicks could not be doing better. This indicates that grit containing small shiny particles should not be used for very young chicks. Much mortality among chickens also takes place through their eating pieces of fibrous green material, which also blocks the gizzard. All green stuff for chickens should be fed fresh and tender and be cut up fine. The feeding of green material, such as grass of undesirable length, is specially bad where no grit is fed with it. Providing it is of the right quality, grit should be mixed with the first few meals a chicken receives. After then it should be placed in a shallow dish and left for the chick to pick at when required. Charcoal is another necessity, if bowel trouble is to be kept in check. It should be fed in a similar manner to grit.

Chicken-rearing is a business of little details, and if these are not observed in every respect the best results cannot possibly be achieved.

THE IMPROVED FIRELESS BROODER.

In my description of this brooder in last month's *Journal* it was stated (p. 36, second paragraph) that the fresh air enters through the openings in the front board, and passes out at the back of the hover, where there is a space of about 1 in. by ¾ in. This was a typist's error for 1¾ in. The correct space, however (between the hover-frame and the brooder-box), is 2 in.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

EVERY advantage should now be taken of fine days to make a thorough examination of each hive in the apiary. At this time the bees are usually very busy gathering nectar and pollen from the early-flowering shrubs and fruit-trees. During such times, when the weather is fine, very little smoke is required, for the bees being fully occupied do not resent interference as they do when there is little to gather. It is not advisable to use much smoke at the entrance at any time. Two or three puffs of the smoker should be sufficient for most hives. Then on removing the hive-cover give a few more puffs as the mat is being removed. Cloth or sack mats are an advantage in this respect, as one corner can be gently lifted and the bees smoked as it is removed.

It will be found that old dry sacking is the best fuel to use in the smoker. Care should always be taken to see that a plentiful supply of fuel is handy, and that the smoker is alight before commencing operations. The smoker is perhaps

the beekeeper's most useful tool, and too little care is often taken to see that it is in good working-order. Frequent attention to the nozzle and the small outlet in the bellows is necessary to enable it to work freely, as they are very apt to become choked with dirt and carbon. Nothing irritates the bees more quickly than to start puffing on them with a smoker that is not alight and smoking freely.

When examining the hives it is necessary to have a notebook or other means of recording the state of each colony. In order to do this each hive will require to be numbered. Small pieces of cardboard on which to make rough notes are useful. These can be placed under the lids, and the notes copied later into a book.

The main object of examination of hives at this time of the year is to ascertain the exact condition of each colony, so as to remedy as far as possible any defects that may be found. The first care of the beekeeper is usually to mentally note the number of frames the bees are covering. Then on removing each frame he carefully examines the brood to see if the dreaded disease foul-brood is present. Should he be unfortunate enough to find it he should immediately close up the hive and mark it for treatment as early as possible.

FOUL-BROOD.

The method of detecting and the treatment for foul-brood has frequently been described, but as it is important that every beginner should be able to recognize the disease when present it may be advisable to again publish this information. The following is the method of detecting and treatment recommended by the Department:—

Detection.—Healthy brood in the larva stage—that is, before it is sealed or capped—presents a clear pearly whiteness, but when attacked, which is usually about the time of capping, it changes to a light buff, then to brown. It is, however, when the brood has been capped that the novice is better able to detect the presence of disease. In the early stage of an attack a capped cell here and there appears somewhat different from the surrounding healthy brood. Instead of the cappings or seals being bright, full, and of convex form, characteristic of healthy brood, they are of a dull blackish-brown colour, and flat or sunken, an indication that the cells contain dead pupæ. The disease rapidly spreads to surrounding cells and combs, if allowed to take its course, till finally no brood can hatch, and the colony succumbs. On opening some of the cells a thin glue-like coffee-coloured mass will be noticed, which on the insertion of a splinter of wood adheres to the point, and can be drawn rope-like for some little distance out of the cells. This is one of the most distinctive features of foul-brood prevalent in New Zealand, and where present it is considered conclusive evidence of the disease. Later on this glue-like substance dries up into the before-mentioned black scale-like body. Other symptoms are "pin-holes" and ragged perforations in the cappings of the cells and a very disagreeable smell resembling that of heated glue, which may be sometimes detected at some yards away from a badly infected hive in close weather. The characteristic odour cannot easily be detected in the earliest stages, even when an infected comb is placed close to the nose, but some slight difference can be noticed between that and healthy comb at all times.

Treatment.—The present system, commonly called the "McEvoy" treatment, when properly carried out, gives an effective cure which has been repeatedly tried with absolute success in many thousands of cases in this country. Where the disease is so far advanced as to have left few bees in the colony, then it will be safest to destroy by fire everything that has been in contact with it. "Tinkering" with such a colony would be both useless and dangerous. Treatment may be undertaken at any time of the year, providing the weather is not too cold to prevent the bees building comb. In the southern parts of the Dominion, if treating in the cold season, the bees should be put on to drawn-out combs and fed with warm syrup, or the bees put on to frames of clean honey, if procurable, and left until the spring. All operations in this connection should be carried out in the evening, when the bees are quiet. Prepare a clean hive and bottom-board, with narrow starters of comb-foundation in the frames. Remove the infected hive and stand to one side, and put the prepared one in its place, prop up the front about an inch, lay a sack near the entrance, and shake and brush the bees as quietly as possible close to the entrance. When finished remove every vestige of the infected hive away where bees cannot get at it. The combs, if not too badly infected, may be melted into wax, or, if insufficient in quantity for that purpose,

they, with their frames, had better be burned right away and the residue buried. The hive, bottom-board, and cover, if sound and worth saving, should be cleaned and thoroughly disinfected with a strong solution of carbolic acid or other disinfectant, or singed inside by fire. On the evening of the fourth day following, the necessary number of frames for the hive should be furnished with full sheets of comb-foundation, to be exchanged with those the bees have been working on. This can be done by removing the frames one at a time, shaking the bees back into the hive, and inserting the others. The comb built on the starters during the four days may be cut out and melted up, and the frames disinfected. The theory of this treatment is that during their four days' comb-building the bees use up all the infected honey contained in their honey-sacs when taken from their old hive, so that when shifted again at the end of the four days they start clean.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

Asparagus: Growth will now have started; the heads may not have shown through the surface, but they have begun to move underground. This is the best time to plant, as the plants start growth at once, consequently there is no loss of roots, which is almost sure to occur with early planting, resulting in weakened plants. There should be no delay now, and the roots should be exposed to air as little as possible during the operation. When the plants are lifted they should be placed between damp sacking for conveyance to the planting-ground. Everything should be ready for planting and the operation completed as quickly as possible. Planting methods have recently been described. Established beds may now be given a dressing of nitrate of soda, 1 oz. per square yard. Where old-fashioned beds exist, and these have been stripped of the top soil and a layer of manure laid on, the soil should now be returned. It is best to keep the soil off as long as possible. The manure decomposes best when exposed to the nitrifying effects of the air, and, more important still, if the soil is thrown up too early it gives weeds time to grow before the asparagus starts, involving needless work in weeding or the expense of treating them. Where weeds are present in troublesome numbers they can be killed by a dressing of salt; about 4 oz. per square yard will usually suffice.

Onions: In most places these are well started by now. The hoe or cultivator should be used as frequently as possible, so as to keep the surface open. The plants will not thrive if the surface soil becomes close, as air is necessary. Nitrate of soda is very beneficial to onions, but should not be given until transplanted sets have commenced new growth, and in the case of sown beds not until thinning has been done. If applied to unthinned rows the accelerated growth is likely to draw the plants up and make thinning difficult, besides which the crowded plants are made weak when separated. Where they are grown for salading it is suitable to apply the nitrate to the unthinned rows.

Celery: In places where the climate is of a medium order it is customary to sow in the open ground for the main and late crops, the sowing being made about the middle of September. This saves a good deal of labour, as against raising the plants in boxes. The latter must, however, be done in extra warm places where the surface soil dries out so quickly as to make it practically impossible to raise the plants in the open air. Early-sown batches will be ready for pricking off, which should be done as soon as the plants can be handled. Boxes about 2½ in. deep inside should be half filled with fairly fresh stable manure; press the manure down tight, then fill the boxes heaped up with a compost of good soil with about one-third well-decomposed manure; stroke off level with a piece of batten, press the soil firm with a dry brick or piece of board, and prick the plants out about 2 in. apart. Water well, and shade for a few days. Sprinkle the plants with clean water several times every fine day. Watering should be carefully attended to; never allow the soil to become dry. If this happens the plants are

sure to be attacked by aphis, thrips, or red spider. Where celery-rust is prevalent the plants should be frequently sprayed with 2–2–40 bordeaux, beginning while the plants are in the seed-boxes, repeating every ten or twelve days until the plants are set out in the trenches, and after that sufficiently often to keep the plants covered with the mixture practically the whole time.

Cabbages and cauliflowers should now be growing freely. If growth is not altogether satisfactory give a dressing of nitrate of soda, ¾ to 1 oz. per square yard, repeating the application five or six weeks later. New sowings may be made at once to provide heads during February and March.

Rhubarb: Good establishment of the summer variety is frequently prevented by taking the stalks for use during the first season. This should not be done. The first season all the growth made should be allowed to remain and die down on the plants. A good crop can then be had the following season, and not otherwise. A mulch of stable or farmyard manure applied when hot weather begins will materially assist growth.

Winter rhubarb: I believe the best results are obtained by raising the plants from seed, which may be sown during September or October in warm places. The seed may be sown in drills 12 in. apart, dropping two or three seeds at intervals of 12 in. Some thinning will be necessary, and will be advised on later.

Celeriac: This vegetable, known as turnip-rooted celery, is deserving of more extensive culture. The part of the plant used is the swollen root, a formation somewhat like the swollen stem of kohl rabi, with the difference that the stem protuberance of celeriac is beneath the surface of the soil. It can be boiled as a vegetable or used in soup. The flavour is identical with celery-root, and is much liked by those who use it. The cultivation is the same as for celery, except that trenches are not required.

Leeks: Seed should be sown during the first two weeks in September, in shallow drills for transplanting.

Tomatoes: Seed should be sown during the last week in August.

Carrots and parsnips: In the cold parts of the Dominion the main sowing should be made about 15th September. In the warmer districts the first week in November is early enough.

Red beet: A turnip-rooted variety may be sown at once for first use; the long varieties are best for winter use. The times mentioned for carrots and parsnips are suitable for beet. Any one wishing to make one sowing answer for both early and late use should grow Henderson's non-bleeding beet. This variety grows rather large, but can be cut asunder before being cooked and will retain good colour; its quality is excellent.

Turnips: During the spring and summer months turnips do not stand long. Sow comparatively small lots at intervals of seven or eight weeks.

Peas: Sow at intervals of about fifteen days.

Lettuces: Sow in drills, the plants to be thinned instead of transplanting.

Radishes: Sow in small lots every ten or twelve days.

Potatoes: Early crops should be well up by now. Keep the soil well cultivated, and mould up little by little as growth is made. This provides some protection against late frosts. Main-crop planting should be done about the middle of next month in the warmer parts where summer droughts are experienced, so as to secure a good start before dry weather sets in.

Inquirers have asked for information about a mixture for dipping the sets as a preventive of disease. It should be distinctly understood that dipping cannot possibly have any effect on blight, which either comes from diseased tubers, in which case the disease is inside the latter, or from wind-borne spores which attack the haulm. Cases have been known of serious loss from dipping, this having injured the eyes, the sets failing to grow.

Starlings and Fruit.—The *Agricultural Gazette of New South Wales* states that a number of starlings were recently shot at the Bathurst Experimental Farm orchard, and the contents of their stomachs examined. These showed both grass-seed and apple-flesh, the latter predominating.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

LINSEED-CULTURE.

E. J. H., CRICKLEWOOD, South Canterbury :—

I am thinking of putting in some linseed, and should be glad of advice as to the best time to sow it, the cultivation required, and the depth and width between drills. Does it need to be dead-ripe before cutting, and is it easily shaken out ?

The Fields Instruction Branch :—

The time to sow linseed is when danger of severe frosts is past. Seed at the rate of from 20 lb. to 30 lb. per acre, sowing through every coulter of the drill to a depth of from 1 in. to 1½ in. Heavy land will give the best results, but if the rainfall is well distributed the lighter lands often give good results. If your land is of good quality it should not be necessary to apply fertilizers, but if it appears to be in any way deficient in quality drill in at time of seeding 1½ cwt. per acre of basic superphosphate. In an ordinary year a linseed crop should be ready to cut for seed in from sixteen to eighteen weeks from time of sowing. It should be cut for seed when the field is turning brown, as if left to become dead-ripe the loss of seed would be considerable, especially if warm weather conditions prevailed.

SYRINGING COWS AGAINST ABORTION.

J. H. D., Spring Creek :—

Would the syringing-out of cows when they are from five to six months in calf aid towards the prevention of abortion in the seventh and eighth months of pregnancy ? If so, what is the best mixture to use ?

The Live-stock Division :—

The syringing-out of your cows as suggested would certainly aid towards the prevention of abortion. Great care, however, would have to be exercised in the selection and use of an agent for your purpose. A solution of the perchloride of mercury (1-5,000) should be sufficiently strong. Obtain a dozen tablets from your chemist. One tablet in 2 quarts of water that has been previously boiled would give you the required strength. The external genitals, the tails, &c., should be wiped over with a cloth wrung out in a disinfecting solution every day.

SUNFLOWER-CULTURE.

H. S., Timaru :—

I should be glad of your advice regarding sunflower-culture.

The Horticulture Division :—

The sunflower, if it does well, is a gross-growing plant. It therefore requires good soil, and even if the soil is in good heart an addition of fertilizers would be beneficial. You are advised to apply 2 oz. superphosphate, 1 oz. sulphate of potash, and 1 oz. sulphate of ammonia, each per square yard. The variety recommended is the Russian. In the warmer parts of the Dominion seed may be sown in the open ground with as good effect as if raised otherwise. In your climate it would doubtless be best to raise the plants under glass, sowing near the end of August and planting out early in November, thus obtaining a longer growing

season than would be obtained by direct seeding. Plant in rows about 28 in. apart and 15 in. apart in the rows. The heads should be ready for harvesting during March. Cut them with a few inches of stem, and hang them in a dry, airy shed with canvas spread beneath to catch falling seeds. When the heads are thoroughly dry the seed is easily shaken out.

GROWING TURNIPS FOR SEED.

"FARMER," Riversdale :—

I intend sowing turnips for seed this year, and shall be glad of advice as to the best time to sow and the seeding required. If sown in early spring would they be ready to cut in the autumn? Will the ordinary turnip-machine be sufficient?

The Fields Instruction Branch :—

It is very doubtful whether an early-spring-sown crop could be harvested for seed in the autumn, hence instead of sowing in the spring we would suggest late summer sowing—say, in February or even later—using 4 lb. to 8 lb. of seed and sowing in rows 7 in. to 14 in. apart. This would allow of considerable thinning-out of roots which are not true to type. You will also need to take precautions that other varieties of turnips are not flowering in the vicinity, otherwise there will be a great danger of crossing. For a full discussion on turnip-seed growing you are referred to the articles in the *Journal* for June, 1918, and November, 1919. It may be mentioned that merchants report that supplies of turnip-seed are freely coming to hand from Europe, this indicating that the war-period shortage no longer exists.

ARSENIC SPRAYING FOR KILLING BLACKBERRY.

"POISON," Opoutama :—

Can you inform me of the best way to mix arsenic for poisoning blackberries? How many gallons of water are required to each pound of arsenic? Is caustic or washing soda the better solvent? Is it advisable to use a copper boiler for mixing?

The Live-stock Division :—

So far a reliable specific for killing blackberry has not been discovered, though good results have been obtained on some lands by spraying heavily with a mixture consisting of 3 lb. arsenic and 2 lb. caustic soda. Dissolve in 3 gallons of boiling water, and add 8 gallons of cold water to each gallon of the mixture. Quantities can be increased by using larger supplies of the arsenic and soda in above proportion if required. Stock requires to be kept off the treated area for at least two weeks. The withered blackberry can then be burnt, and after burning an application of the arsenic mixture should be applied to the roots if at all possible. The mixture is best made in kerosene or petrol tins, which can be destroyed afterwards.

TRANSFERRING WILD BEES TO HIVE.

"SUBSCRIBER," Pahiatua :—

Would you kindly inform me if it is possible to transfer a hive of wild bees, and, if so, the best method and time for doing so?

The Horticulture Division :—

The best time to transfer wild bees to a frame-hive is in October, when a honey-flow may be expected. Have the frame-hive in readiness with the frames fitted with full sheets of foundation, and locate it as near as possible to the wild colony, with the entrance facing the same way. Next smoke the bees with a bee-smoker to quieten them, and proceed to uncover the combs, when they may be cut out and the bees brushed into the new hive. If there is no disease present the brood may be tied with string into one or two empty combs, which will have the effect of inducing the bees to adopt the new hive. Care must be taken to transfer the queen, otherwise the bees will not stay. When all the bees have settled for the evening the hive may be removed to its permanent location.

GROWTH ON MARE'S SHOULDER.

"PLOUGHIE," Featherston :—

I have a draught mare that is continually getting a soft lump on her shoulder during plough-work. As a rule the lump forms after ten to twenty-one days' work, but sometimes sooner. It is about the size of half an orange, and the top gets raw without any discharge being apparent. I have tried cutting a hole in the collar, and used gall-cures without success. The mare is practically idle during the time I need her most. Would you kindly advise treatment ?

The Live-stock Division :—

The lump on the mare's shoulder will be likely to recur until some radical means are adopted for its removal. Fomentations, poultices, and blisters are of little or no value in a case of this sort. The animal should be "spelled" till the growth has contracted as much as possible and attained a definite shape and uniform hardness. A slit should then be made over the growth, and the growth secured with a needle and strong twine and dissected out. No further treatment, except a daily washing with some mild disinfecting solution, is necessary. The animal may be worked when the wound is thoroughly healed.

RYE-CORN FOR FOWLS.

"CLACTON," Canterbury :—

I have land suitable for growing rye-corn but unsuitable for wheat or oats. Would it be profitable under the circumstances to feed rye-corn to fowls ? What is the feeding-value of rye-corn as compared with wheat and oats ?

The Chief Poultry Instructor :—

It would probably not pay you to grow rye-corn for your fowls. In the first place it is low in food value as compared with wheat or oats, and secondly it is a difficult matter to make fowls eat it, except when forced to by hunger. Obviously, in view of this, its use will not tend to promote heavy egg-production.

SHORTENING DOG'S TUSKS.

H. S. STRATFORD, Pelorus Sound :—

We have a dog that bites the sheep, and are considering the removal of his tusks. Is this advisable, and how is it done ?

The Live-stock Division :—

The entire removal of the tusks is not necessary. About ½ in. would be enough, and the method of removal is as follows : File round the teeth at the desired spot with a sharp fine file, going well into the enamel. Apply pressure now with a pair of sharp pincers or forceps, and the tooth will break at the file-mark. Dress over any broken edge with the file, and treat the other tusk in a similar manner.

SEPTIC-TANKS AND DISINFECTANTS.

"SEPTIC TANK," Pahiatua : —

My house has its own septic-tank to which all drainage, including that of a water-closet, is led. The effluent, which I understand should be practically pure water, occasionally develops bad smells in hot weather. I am told that the last occupant of the house, with the best of intentions, frequently used to sluice out the sinks with sheep-dip. Would that prevent bacterial action in the tank and account for putrefaction of the effluent ? If so, will the matter remedy itself in time, or should fresh bacteria be added from a septic-tank in good order ?

The Officer in Charge, Wallaceville Laboratory :—

Provided there is no structural defect in the tank, there is little doubt that the trouble arises from the practice you mention as followed by the previous occupier. On no account should disinfectants of any kind be allowed to enter a septic-tank. Strong alkaline solutions, such as washing-soda, will also deleteriously affect the

bacterial activity upon which the function of the tank depends. It is probable that the bad effects will wear off as the properties of the disinfectant used become exhausted, but the time for this would be very indefinite. The tank might be cleaned out and examined for any leaks, &c., and a fresh start made. It is not necessary to add bacteria to the tank. These are present in sewage, and, given the special conditions necessary for their multiplication, will effectually dispose of the contents of the tank.

SHYNESS OF BREEDING IN SOW.

D. A., Whangarei :—

I have a boar and sow both in good condition, not fat, and occupying separate sties, with a run on grass on alternate days. The sow has had one litter of pigs to the boar, and has since been on heat several times, at which period they were put together, but is not yet in pig. Can you advise anything ?

The Live-stock Division :—

It is possible that you may have been a little late in turning the sow in with the boar. The heat period lasts usually about three days, repeating itself every twenty-one days. It often occurs that, having given a sow a rest after weaning her pigs, one is confronted with the difficulty of getting her to breed again. This shyness of breeding may be reduced considerably by feeding on concentrated rather than bulky food. For instance, a few beans or peas, maize, or barley would prove far more suitable food for a sow about to be put to a boar than a large quantity of sloppy and unnutritious food. It would be advisable to let the sow and boar run together, feed the sow on the food mentioned, and watch carefully for results.

RATSTAIL-GRASS.

G. W., Anatimo, Nelson :—

I should be pleased to have your opinion regarding ratstail-grass. It grows on some of the hill country here, and seems to give a lot of feed, the possessors of the country speaking well of it. It is of a tussocky nature and very tough, so that animals pasturing on it need good teeth. It will also stand firing. Is the feeding-value good enough to warrant its inclusion in seeding fern-clearings or bush-burns ?

The Fields Instruction Branch :—

Ratstail (*Sporobolus indicus*) is an inferior grass and has the power of choking out better grasses. One of its drawbacks is its very harsh herbage, which makes it useless for broken-mouthed sheep. At one time a considerable amount of seed was sown, but it is now becoming almost entirely discarded. Although it may be of some value in certain situations and circumstances, it cannot, as a rule, be recommended for seeding fern-clearings or bush-burns.

FOOT TROUBLE IN HORSE.

J. M., Waipu :—

One of my farm horses suddenly became lame, a soft lump forming behind and near the frog of the hoof. After a couple of days the lump broke and black matter bubbled out for two or three days. Recovery took place in about three weeks. I should be obliged for information as to cause and treatment.

The Live-stock Division :—

The trouble is probably due to an injury such as a nail or sharp piece of manuka penetrating the horny frog and injuring the sensitive tissues underneath ; or it may be due to dirt penetrating the frog at some faulty part and setting up inflammation and suppuration. Such a case is best treated by paring the horn from the affected part, and allowing free drainage for the matter to get away. The foot should then be placed in an antiseptic foot-bath, or poulticed, until the discharge has ceased. The animal should then be shod with a leather sole. A liberal application of tar and tow to the affected part before shoeing will prove beneficial.

IMPERIAL GOVERNMENT WOOL-PURCHASE CONTRACT.

THE following statement was made by the Prime Minister, Mr. Massey, under date 28th July, in reply to a question in Parliament on the subject:—

My attention has been drawn to a statement of the 26th instant by Mr. William Milne, of Oamaru, that a very serious mistake was made in the original contract for the purchase of the New Zealand 1916–17 wool-clip and perpetuated in the contracts entered into for the purchase of the 1917–18, 1918–19, and 1919–20 clips.

I was in England at the time the original contract was entered into, and was in close touch with all the proceedings, and the cables to and from the Imperial Government passed through my hands. Mr. Milne states that the Imperial Government's offer was a cash advance of 55 per cent. over the net proceeds in London, less 1¼d. per pound for freight and expenses, plus half-profits on wool not used for military purposes. The first offer by the Imperial Government was to purchase the New Zealand wool-clip at an increase of 45 per cent. on the average price realized for each quality of New Zealand wool during the season 1913–14, all charges from delivery to broker's store to be paid by the Imperial Government, and half any profits made on the sale of New Zealand wool for other than military purposes to be returned to growers, any loss to be borne by the Imperial Government. The counter-offer of the Conference of New Zealand Wool-growers, sitting in Wellington on the 14th and 15th November, 1916, and transmitted to the Imperial Government, was that the offer of 45 per cent. increase on merino wool was accepted, but other classes to be purchased on the basis of the average sale prices in New Zealand in January, 1916, estimated to be as follows: Super, half-bred, 1s. 7½d.; medium to good half-bred, 1s. 5d.; inferior half-bred, 1s. 2d.; super crossbred, 1s. 6½d.; medium to good crossbred, 1s. 4½d.; inferior crossbred, 1s. 1½d.; Lincoln and Leicester, 1s. 3¾d.; lambs, good, 1s. 4¾d.; lambs, inferior, 1s. 1¾d. The Imperial Government returned with an offer of an increase to 55 per cent. on the average price realized for each quality of New Zealand wool during the season 1913–14. The second Conference of New Zealand Wool-growers, held in Wellington on the 22nd November, 1916–17, agreed to accept this offer, provided it was based on the following figures to be taken as the average for 1913–14: Superior merino combing, 1s. to 1s. 2½d., plus 55 per cent., 1s. 6½d. to 1s. 10½d.; medium to good merino combing, 9¾d. to 11½d., plus 55 per cent., 1s. 3¼d. to 1s. 5¾d.; inferior merino, 8½d. to 9½d., plus 55 per cent., 1s. 1¼d. to 1s. 2¾d.; superior half-bred, 1s. to 1s. 2d., plus 55 per cent., 1s. 6½d. to 1s. 9¾d.; medium to good half-bred, 9¾d. to 1s., plus 55 per cent., 1s. 3¼d. to 1s. 6½d.; inferior half-bred, 9d. to 10d., plus 55 per cent., 1s. 2d. to 1s. 3½d.; superior crossbred, 10½d. to 1s., plus 55 per cent. 1s. 4¼d. to 1s. 6½d.; medium to good crossbred, 9d. to 11d., plus 55 per cent., 1s. 2d. to 1s. 5d.; inferior crossbred, 7¾d. to 9d., plus 55 per cent., 11¾d. to 1s. 2d.; Lincoln and Leicester, 8¾d. to 10½d., plus 55 per cent., 1s. 1¾d. to 1s. 4¼d.; lambs, good, 11d. to 1s. 1d., plus 55 per cent., 1s. 5d. to 1s. 8¼d.; lambs, medium, 9d. to 10¾d., plus 55 per cent., 1s. 2d. to 1s. 4¾d. This basis was agreed to by the Imperial Government.

The contract for the purchase of the 1916–17 clip was later extended, with the approval of wool-growers, to cover all wool clipped up to the 30th June, 1920, but in the arrangement for the purchase of the 1918–19 and 1919–20 clips I was able to secure a very important concession from the Imperial Government under which an amount will be returned to New Zealand wool-growers as surplus profits on this wool at the same rate per pound as is returned to Australian wool-growers, provided same does not exceed 100 per cent. of the profit actually made on these New Zealand clips.

The arrangement for the purchase of freezing companies' slipe wool produced up to the 30th June, 1917, was 55 per cent. on the average price per pound received from each and every grade produced by each company and sold in London between the 1st January and the 31st December, 1914, less 1¼d. per pound, representing shipping expenses, freight, and other charges. After the 30th June, 1917, freezing companies' slipe wool to be purchased on the basis of 55 per cent. on the average realizations in London from the 1st July, 1913, to the 30th June, 1914, less 1¼d. per pound. The schedule was prepared on this basis, and valuations have

been made in accordance with same. The only alteration made in 1918 in the arrangement for the purchase of freezing companies' slipe wool was that whereas wool produced to April, 1918, was valued in London, wool produced subsequently was valued in New Zealand. Under both arrangements freezing companies were required to put their wool f.o.b. at their own cost. In view of Mr. Milne's statement that the average London prices from the 1st July, 1913, to the 30th June, 1914, were very considerably higher than the basis of prices taken for the greasy clip, I may state that the clean-scoured cost of the valuation schedule for slipe wool (which is necessarily based on London prices, as all slipe wool was sold there) is lower than the clean-scoured cost of the valuation schedule for the greasy clip.

IMPORTATION OF FERTILIZERS: JUNE QUARTER, 1920.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 30th June last, the name, quantity, and value of each kind, together with country of departure, being specified :—

Sulphate of Ammonia.—United Kingdom, 3 tons, £69; Australia, 26 tons, £1,173: total, 29 tons, £1,242.

Gypsum.—United Kingdom, 3 tons, £42; Australia, 149 tons, £360: total, 152 tons, £402.

Nitrate of Soda.—Australia, 169 tons, £4,447; Chile, 248 tons, £3,459: total, 417 tons, £7,906.

Basic Slag.—United Kingdom, 769 tons, £6,961.

Blood-and-bone.—Australia, 10 tons, £219.

Bonedust.—Australia, 905 tons, £12,427.

Char Dust (Bone Char).—Australia, 155 tons, £1,126.

Guano.—Australia, 130 tons, £595; New Caledonia, 818 tons, £4,611: total, 948 tons, £5,206.

Rock Phosphate.—Australia, 1,364 tons, £5,878; Makatea Island, 7,400 tons, £18,315: total, 8,764 tons, £24,193.

Superphosphate.—Australia, 1,277 tons, £9,262.

Other Phosphates.—Australia, 211 tons, £1,028; Egypt, 5,010 tons, £34,716; United States of America, 2 tons, £39: total, 5,223 tons, £35,783.

Kainit.—United Kingdom, 1 ton, £18; France, 120 tons, £801: total, 121 tons, £819.

Sulphate of Potash.—United Kingdom, 113 tons, £3,359; France, 20 tons, £596; Germany, 15 tons, £366: total, 148 tons, £4,321.

Sulphate of Iron.—United Kingdom, — tons, £5; Australia, 20 tons, £212: total, 20 tons, £217.

Other Fertilizers.—United Kingdom, 1 ton, £14; Australia, 29 tons, £287: total, 30 tons, £301.

NOTE.—With regard to the "declared values" which are given above, the Comptroller of Customs gives the following explanation: "The value for duty is the fair market value in the country whence the goods are imported plus 10 per cent. As the addition of 10 per cent. does not nearly cover the present freight, insurance, and other charges, the statistical value is a long way less than the actual landed value."

Whitewash.— The following makes an effective wash for the inside of loose-boxes, cowhouses, and also for outside brickwork: Take ½ bushel unslaked lime, slack with boiling water, and cover to keep in the steam. When cool strain through a fine sieve. Add 1 peck salt dissolved in warm water (saturated); 3 lb. ground rice, boiled to a thin paste and stirred in while hot; ½ lb. Spanish whiting; 1 lb. glue, previously dissolved by soaking in cold water, and then melted in a water bath. Dilute with 5 gallons warm water, and allow the mixture to stand a few days before using, well covered from dust. This preparation is known as "Lighthouse" whitewash.

THE FERTILIZERS ACT AND "IDEAL GRASS MANURE."

At the Magistrate's Court, Auckland, on 18th July last, Frank M. Winstone was charged with having sold a fertilizer (Ideal Grass Manure*) the analysis of which was at variance with the invoice certificate, to the prejudice of the purchaser. The information was laid on behalf of the Department of Agriculture, whose Inspector had taken the samples under the Fertilizers Act. The analysis made by the Department had disclosed a deficiency in soluble nitrogen to the extent of 0·40 per cent. out of 0·60 per cent., and 0·85 per cent. out of 2 per cent. insoluble nitrogen, supposed to be present, or 48 per cent. less than the guarantee of total nitrogen. The evidence showed that at least eight bags of the manure were sampled, and in each case the samples were taken from various portions of the contents so as to secure a fair average.

The defendant, while admitting the offence under the Act, maintained that the bulk was not deficient in the guaranteed quantity of nitrogen. He stated that at the time of the last registration the nitrogenous element was supplied by animal nitrogenous manure capable of being reduced to a fine powder. Owing to shortage in this ingredient it had later been necessary to use nitrate of soda. This was in crystal form and did not crush and mix readily with the other ingredients.

The Magistrate said he was prepared to deal with the offence as a case of an invoice made without knowledge that the goods did not comply with the certificate, but there was an obligation on the part of the vendor to make sure that the mixture was correct, the matter being a serious one for farmers. The defendant was convicted and fined £5, with costs £1 8s.

Although the point of deficiency in *insoluble* nitrogen (0·85 per cent.) was not specially referred to in the Court proceedings, it should be clearly understood that the stated imperfect mixing of the nitrate of soda does not account for such deficiency, the nitrogen in nitrate of soda being wholly soluble.

* The minimum composition of Ideal Grass Manure, as guaranteed by the vendor, and registered under the Fertilizers Act for the year 1919–20, was as follows: Nitrogen—soluble 0·60 per cent., insoluble 2 per cent.; phosphoric acid—soluble *nil*, insoluble 17·84 per cent.; potash, *nil*. See Serial No. 193, in list of fertilizers published in *Journal* for July, 1919, page 45.

LAND FOR RETURNED SOLDIERS.

During the month of July an area of 18,028 acres was made available for selection by discharged soldiers. This area was subdivided into thirty-nine holdings, and mainly consisted of good dairying and grazing country. One pastoral run of 3,500 acres is included in the area.

During the month of August a total area of 60,545 acres is available for selection, and is subdivided into 151 holdings. Included in this area are three small grazing-runs of a total area of 5,645 acres, situated in the Nelson Land District. Several large blocks of Crown land in the Auckland Land District are made available; the areas of these sections range from 114 acres to 2,872 acres.

In the Auckland District, Orongo and Selwyn Settlements, containing a total of 756 acres, situated on the Waihou River and at Lichfield respectively, will be opened on the 17th September. Linkwaterdale Settlement, of 450 acres, in the Marlborough District, is to be opened on 7th September.

The principal blocks of Crown land to be opened in September are 2,857 acres situated near Owhango, in the Wellington Land District, consisting of partly cleared heavy-bush land, and 2,649 acres near Murchison, in the Nelson District, consisting of heavy-bush land.

Unidentified Subscription.—A 2s. 6d. postal note, No. 686961, issued at Manukau on 5th August, 1920, together with 1s. 6d. in stamps, have been received without letter of advice. The sender should communicate name and address.